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SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

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SYMPOSIUM ON CARCINOMA OF THE JAWS, TONGUE, CHEEK, AND LIPS

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CARCINOMA OF THE JAWS, TONGUE, CHEEK, AND LIPS

GENERAL PRINCIPLES INVOLVED IN OPERATIONS AND RESULTS OBTAINED AT CLEVELAND CLINIC [1]

BY G. W. CRILE, M.D., F.A.C.S., CLEVELAND, OHIO

IN the brief time allotted to individual papers in this symposium, it is impossible even to summarize the important contributions to the literature pertaining to operations for carcinoma of the mouth which have been made by many surgeons, notably those which have proceeded from Boston, New York, Philadelphia, Rochester, Chicago, Baltimore, New Orleans, and other centers. I shall, therefore, without discussion of the points of view of others, confine myself to an enunciation of the principles based on the work in the clinics of these cities in accordance with which our surgical management of these cases is planned.

A study of the literature pertaining to cancer of the head and neck shows that among 4,500 reported autopsies, in only 1 per cent were secondary foci found in distant organs or tissues. That is, when death results from a cancer of the head or neck, it is because of local and regional development of the disease, not by distant invasion. The collar of lymphatics about the neck forms an almost impassable barrier through which cancer rarely penetrates; and every portion

[1] Presented before the Clinical Congress of American College of Surgeons, Boston, October 26, 1922.

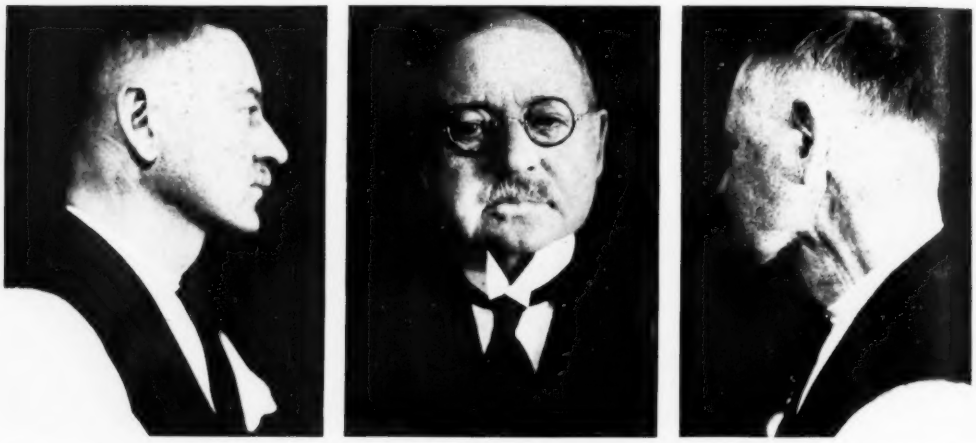

Fig. 1. End-result of bilateral block dissection of glands of neck for carcinoma of the tongue. Nine years after operation.

of this barrier is readily accessible to the surgeon. After the lymphatic stream has been blocked by carcinomatous invasion, it may flow in any direction, and every sort of irregularity in the further metastases may follow, but the metastases will still remain within the accessible lymphatic collar.

As far as metastatic dissemination is concerned, therefore, cancer of the head and neck presents a far more favorable outlook than does cancer of the breast with its thoracic and abdominal metastases or cancer of the stomach or intestines with its inaccessible retroperitoneal and liver metastases.

Within the lymphatic collar, because of the rich supply of lymph nodes and their connecting channels, metastases are rapidly disseminated, although cancer of each part of the head seems to follow a law of its own so far as its primary extension is concerned. Thus, cancers of the skin, of the mucous membrane of the cheeks, of the mucous membrane of the edge of the jaw, usually do not metastasize; cancers of the lip almost uniformly metastasize to the lymphatic glands under the jaw; cancer of the floor of the mouth usually metastasizes in the glands of the same side. Paired organs or distinctly one-sided foci usually metastasize regularly; while unpaired organs, as the tongue, or mesial tissue, such as the middle of the lip, metastasize irregularly and widely. For example: a marginal cancer of one side of the tongue may metastasize to the glands of the opposite side, although usually low down toward the clavicle, although the metastasis may occur at any site, high or low, on the right or the left side.

These facts give us the key to our *first principle*—the removal *en bloc* of the pertinent lymphatic glands. Thus, early cancer of the mucous membrane of the gingivæ or cheek which metastasizes late does not demand excision of the glands; while cancer of the lip, however early, demands the complete excision of all lymph nodes which drain the involved area; and cancer of the tongue or of the lip calls for the complete removal of the glands of the neck on both sides. Cancer of the jaws which metastasizes rarely, and usually on the side of the lesion, demands a less radical operation.

In advanced cases, no matter where the primary lesion, a wide regional block excision is demanded. Complete bilateral excisions can be made with an interval of several weeks without fear of ill results, the easiest technique involving excision of the sternomastoids and of both jugular veins *en masse* with the lymphatics. The disfigurement is not striking; and since the adoption of this method in 1898–1899, we have rarely missed

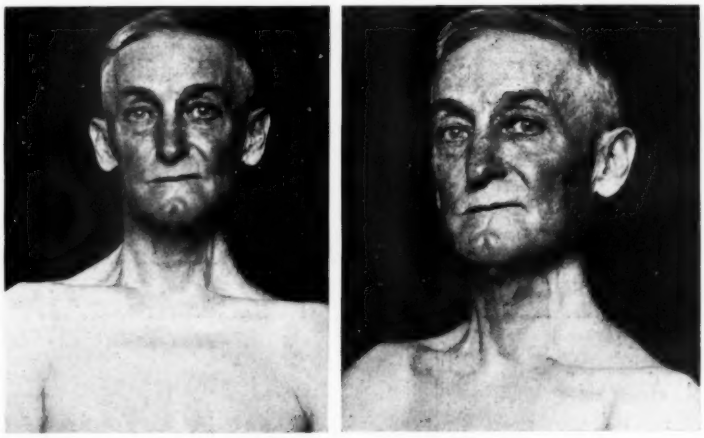

Fig. 2. End-result of bilateral dissection of glands of neck for epithelioma of the lip. Fourteen years after operation.

securing a permanent cure in any case which had not progressed beyond the lymphatic planes of the neck.

The second fundamental principle is suggested by the fact that the most common cause of death after operations which involve the mouth is bronchopneumonia resulting from the inhalation of blood or of wound secretion. The inhalation of blood or of wound secretion, therefore, must be prevented at any cost. This is accomplished by scrupulous hæmostasis during operation and by means of tubage and gauze packing of the pharynx; by administering the inhalation anæsthetic through rubber tubes passed through the nares; by intralaryngeal catheterization; by maintaining the lightest possible degree of anæsthesia, the main dependence being placed upon local anæsthesia, so that the conscious patient can aid in the prevention of inhalation of blood. Deep ether or chloroform anæsthesia are especially unfavorable on account of the danger of postoperative vomiting and a fatal inhalation of fluid. Ether is contraindicated also because it increases the danger of pneumonia.

Inhalation of blood or wound secretion after the operation is controlled by the attention of specially trained nurses, who are on duty continuously day and night, keeping the wound constantly clean and free by means of moist cotton pledgets, sprays, and washes.

The third principle is the prevention of a resowing of the cancer by wide excision and by the control of hæmorrhage. Hæmorrhage necessitates sponging. Sponging involves the surface of the cancer so that cancer cells may adhere to the sponges and be resown upon the fresh and fertile field. A resultant new-growth may kill the patient much earlier than the primary lesion would have done.

In the case of a cancer of the tongue, hæmostasis may be secured by a preliminary ligation of the linguals; or a dry field can be insured by the employment of mattress sutures in a wide zone around the focus.

CHOICE OF OPERATIVE METHOD

In certain cases cauterization is the method of choice for the removal of the primary focus. It must be borne in mind, however, that carcinoma of the jaws is usually the result of direct extension from the primary foci on the mucous membrane. Surgically two courses are open—one of which is to remove with a chisel or saw a margin of bone underlying the entire field of invasion with a sufficient adjacent margin of uninvaded tissue. That is, the incision around the cancer area to be excised is carried down to the underlying bone, and thence into the bone by

Fig. 3. End-result of unilateral block dissection of glands of neck for carcinoma of the lip. *a*, Thirteen years after operation; *b* and *c*, sixteen years after operation.

a sharp chisel or saw, so that a slice of the bone can be split off in one piece, bearing the undistributed cancer as on a bone platter.

Cancer within the mouth may be destroyed completely and more easily by the cautery than by surgical operation. But it must be borne in mind that straight surgery produces the best scars. The cautery, especially in cases of cancer of the cheek or well back on the jaw sometimes produces badly contracting scars. In several of my cases the scar contracted so as to set the teeth as in lockjaw, demanding a plastic operation. A plastic operation in a postoperative cancer field should be avoided. In general, we favor the use of a single postoperative high voltage X-ray treatment along with radium.

Our conception of the principles involved in operations upon cancers of the cheeks, lips, jaws, and tongue may be summarized as follows:

1. The primary focus may be destroyed by a cautery or removed by excision.

2. Local excision of only the primary focus of the tongue, lip, and floor of the mouth, leaving the regional lymphatic glands, is as ineffectual as excision of the breast without removal of the regional glands.

3. Excision of individual lymphatic glands not only does not afford permanent cure, but is usually followed by greater dissemination and more rapid growth.

4. The logical technique is a complete block excision of the regional lymphatic system together with a wide excision of the primary focus.

5. In operations for cancer of the buccal mucous membranes, a "platter" of underlying bone should be removed together with the intact growth.

6. No cancer tissue should be cut or handled.

7. The inhalation of blood and of wound secretion must be rigidly prevented during and after the operation.

8. Ether and chloroform should be used with greatest caution if at all; gas-oxygen combined with local anæsthesia or local anæsthesia alone is the choice.

9. A single treatment with deep, accurately measured X-ray or radium dosage is employed after operation.

10. The records of operations by my associates and myself include 224 cases of carcinoma of the buccal surfaces—lip, mouth, tongue, jaws, with 6 operative deaths.

CARCINOMA OF THE TONGUE

General Principles Involved in Operations and Results Obtained at Mayo Clinic [1]

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Mayo Clinic
AND
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In spite of the fact that cancer of the tongue, because of its location, is detected in the early stages, the results of treatment have not been satisfactory, chiefly because physicians and dentists have not appreciated the importance of the treatment of precancerous conditions, and of diagnosing and treating early malignancy. In many instances early lesions are not treated, or they are only superficially cauterized, or treated with radium or silver nitrate. The patient is then dismissed from observation, and these almost insignificant lesions gradually progress to conditions of hopeless malignancy. We are beginning to derive benefit from Bloodgood's propaganda of directing the attention of the members of the medical and dental professions, and the laity to this important subject. Such campaigns will probably do more than improved technique, or the employment of any of the newer agents for the treatment of cancer. It is the duty of every physician who is consulted with regard to an apparently insignificant lesion completely to remove the lesion and to determine its exact character as early as possible.

ETIOLOGY

Leucoplakia, particularly the papillary type, is one of the best examples of a definitely benign lesion becoming malignant. Usually such a lesion remains almost quiescent or at least changes little over a period of years and then develops into an active type of cancer. We believe that every case of leucoplakia is curable if treated early; if treatment is postponed until malignant change occurs, certain cases only will be curable. A review of our cases of cancer of the tongue reveals that many of the patients had known of the existence of an area of leucoplakia for some time.

In several cases of cancer of the tongue in old people, repeated treatment for thrush has been the predisposing factor. Syphilis is often a factor in the etiology. If the lesions of syphilis and cancer existed independently, more definite conclusions might be reached, but since the lesions are often present in the same ulcer of the tongue, the problem is complicated. The cancer in such cases probably arises from a gumma, in an old syphilitic scar, or in syphilitic leucoplakia. The areas of epithelial hyperplasia commonly seen in syphilitic tongues may be the beginning of cancer. Many patients who have responded to treatment for syphilis have been carried into a hopeless malignant condition because the double lesion was not recognized. This possibility should be kept constantly in mind in the examination of cases of ulcer of the tongue. If the patient gives a history of syphilis or has a positive Wassermann reaction, the lesion on the tongue may still be epithelioma. In Quick's series of 148 cases, 35.1 per cent gave a history of syphilis or of positive Wassermann reactions, and he believed that the incidence of syphilis is even greater than this. We have not sufficient data concerning our earlier cases on which to base accurate estimations, but we are inclined to believe that syphilis was coincident with cancer in even a greater percentage of cases than in Quick's series, and that in many, particularly in the younger patients, the epithelioma was secondary to the syphilitic lesion.

Besides the leucoplakias and syphilitic ulcers of the tongue, small cracks and benign ulcers are often observed, and occasionally hard, rounded fibromata and papillomata. As benign lesions these are of no consequence, and generally do not cause pain or inconvenience. Nevertheless, in reviewing the his-

[1] Presented before the Clinical Congress of American College of Surgeons, Boston, October 26, 1922.

Fig. 1.

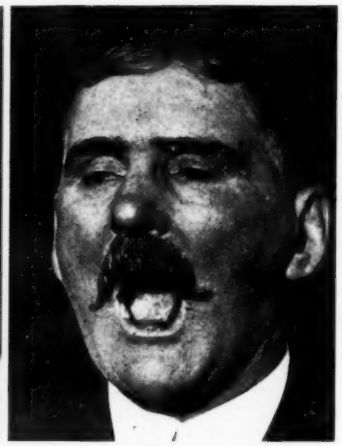


Fig. 2.

Fig. 3.

Fig. 1. Syphilitic leucoplakia of the tongue. Note the fissure down the center of the dorsum of the tongue. (A369031.)

Fig. 2. Syphilitic leucoplakia of the tongue. Note the leucoplakial epithelioma just inside the right angle of the mouth that apparently developed from a syphilitic lesion. (A178521.)

Fig. 3. Syphilitic leucoplakia of tongue. Areas posteriorly on dorsum of tongue are beginning to change and show, microscopically, epithelial hyperplasia. (A275425.)

tories of cases of cancer of the tongue, we find that one of these conditions may have been present for some time before the lesion became malignant. Undoubtedly, in most of these, the benign lesion was precancerous, and its removal, as such, would have prevented malignancy.

Dentists can do a great deal to prevent cancer of the tongue. An old broken or roughened tooth in constant contact with the border of the tongue may result in ulcer formation and later in epithelioma. Proper attention to the teeth might have prevented the original ulcer, and wide excision of the simple ulcer instead of repeated local treatment might have prevented the development of the epithelioma.

In about nine of ten instances cancer of the tongue occurs in men. Personal habits, particularly the use of tobacco, undoubtedly are factors. The irritation from a pipe, and the heat and irritation from cigar or cigarette should affect the lip more often than the tongue; however, the excessive use of tobacco in any form, particularly the irritation from snuff, might affect the tissues of the mouth. Broders, who has made an analytical study of epithelioma of the lip, is inclined to believe that smoking as an etiological factor in the production of lesions of the lip and tongue is considerably overestimated. While the habit of using tobacco may be a factor, irritation from this source can be greatly reduced if the mouth is kept clean. Ulcers of the tongue and of the mouth are excellent illustrations of precancerous lesions. Patients are aware of the lesion early, and with such knowledge it should be possible completely to eradicate ulcers and tumors of the tongue early, and thereby reduce the number of cases in which operation is sought at a time when little or nothing can be done.

DIAGNOSIS

Cancer of the tongue must, in many instances, be diagnosed microscopically. Syphilitic lesions, such as gumma of the tongue, thickened leucoplakia, papillary areas that show only epithelial hyperplasia microscopically, or broken-down tuberculoma of the tongue not associated with pulmonary tuberculosis, may simulate cancer. The hypertrophy of the papillæ on the margin of the tongue posteriorly, which often causes the patient a great deal of trouble should not be treated locally. If there is a suggestion of malignancy, the area should be excised.

Fig. 4a.

Fig. 4b.

Fig. 5.

Fig. 4. Syphilitic leucoplakia of the tongue with epithelioma at the right margin. Note the fissure in the center of the tongue, and the epithelioma on the right margin, one stage further advanced than shown in Figure 3. (A295488.)

Fig. 5. Marked leucoplakia of the tongue with an epithelioma on the right margin near the tip. No definite syphilitic cause. The patient was a very heavy smoker. (A387257.)

Infected cysts, or the more unusual conditions of actinomycosis and blastomycosis, must be excluded. We have seen five patients with actinomycosis of the tongue in the last three years in two of whom a radical operation was recommended for malignancy. Fibromata or warts, particularly if they have been treated, may suggest a malignant condition. The most common differential diagnosis is of syphilitic lesions, simple ulcers, or cancers. It would not be permissible to excise an area of the ulcer and wait for the diagnosis; neither would it be permissible to perform a radical excision of a presumably malignant ulcer of the tongue before a microscopic diagnosis had been made. In such cases tissue should be excised for diagnosis and if it is malignant, the entire ulcer should be removed immediately. The tissue removed should be an area at the margin of the ulcer at the juncture of the normal epithelium and the ulcer, and not at the base of the ulcer. If the ulcer has been treated locally, a report of inflammatory tissue from the pathologist should not be considered absolute.

A high percentage of recurrences follows operations for cancer of the tongue, largely because many patients are operated on at an advanced stage of the disease. The most favorable situation for the tumor is at the tip of the tongue, although only a small number occur at this point; many are found on or near the lateral border. Treatment is more satisfactory if the lesion is on the dorsum and does not encroach on the mucous membrane of the floor of the mouth. Lesions at the root of the tongue are difficult to treat and the results are the least satisfactory. The greater number of such patients present themselves for treatment between the ages of 45 and 60 years. If no treatment is given, the average length of life is about one year.

Cancer of the tongue is nearly always squamous-cell epithelioma. The cylindrical-cell tumor is the exception. The tumor arises from the superficial epithelium or from the epithelial cells of the glands. About 70 per cent of the recurrences occur in the lymph nodes and not in the scar of the operation (von Bergmann, Kuettner). The lymphatic vessels from the mucous membrane and from the deep tissues of the tongue apparently have a single outlet which also takes up the lymph stream from the floor and walls of the mouth. On injecting any area of the tongue the dye is carried to all the glands within the lymphatic system of the tongue, so that the glands on either or both sides may become involved

Fig. 6.

Fig. 6. Early epithelioma of the right margin of a woman's tongue, secondary to a leucoplakia. Syphilis not demonstrated as a factor. (A116365.)

Fig. 7.

Fig. 7. Actinomycosis of dorsum of tongue. Note crater-like ulcer. Referred for malignancy of tongue. (A374014.)

Fig. 8.

Fig. 8. Epithelioma of tip of tongue secondary to thrush, in a patient aged seventy years. Note the white patches (thrush) around the epithelioma near the tip of the tongue (A202825.)

from a growth on any part of the tongue. The gland in front of the internal jugular below the submaxillary group of glands, and one in the deep cervical group just posterior to the submaxillary group are often involved. We have often found these glands affected when it had been impossible to palpate them. If the growth is on the under surface of the tongue, and particularly if the floor of the mouth is involved, there will usually be an early extension to the lymph nodes as well as to the tissues around the inferior maxilla. This extension makes an unfavorable prognosis.

SUMMARY OF RESULTS AT VARIOUS CLINICS

Butlin, in a review of 197 cases of cancer of the tongue, in which he operated, reported that 55 patients (27.8 per cent) were well from 3 to 23 years. None of his patients remained well following operations for recurrence. He says that death was most often due to recurrence in the lymph nodes and not to recurrence of the lesion. The results of operative treatment reported by Bloodgood in his series of 260 cases was 62 per cent of five-year cures for patients operated on in the early stages, and 12 per cent of five-year cures in advanced cases. As he points out, such patients must be operated on early, and operation in the advanced stages cures only a small percentage of patients. Capetti analyzed 777 cases in which operation had been performed in various places and in all stages of the disease. Eighteen per cent of the patients were free from trouble at the end of three years. Caird reported 60 cases and 16 surviving patients. Lathrop and Scannell reported 30 cases from the Boston City Hospital. One patient was alive at the end of 7 years, and one after 5 years. Cobb and Simmons reported 56 cases from the Massachussetts General Hospital, in which 34 patients were operated on with 14.3 per cent cures; all of their cures were in elderly persons. Quick has given a very comprehensive report of the results of the treatment of cancer of the tongue with radium at the Memorial Hospital. He believes that with surgical treatment 75 to 90 per cent of cases will terminate fatally. In his series, only 23 per cent were operable. He asserts that surgery has no place in the treatment of the local lesion, that as long as the lymphatics are nature's barriers, they should not be removed unless they are involved, and that extension to the lymph nodes is embolic and therefore they should not be removed surgically. We have always believed

that in any malignant case, it is better to remove the lymphatics that drain the involved tissues. We have obtained much better ultimate results in operations for cancer of the breast, lip, and particularly the stomach, since we have routinely removed the lymphatics adjacent to such structures. The most satisfactory results have been obtained in cases in which the lymphatics were not found to be involved. If operations were postponed until lymphatic involvement was evident, the ultimate results were very unsatisfactory. Quick reports 148 cases, treated entirely with radium, in the past three and one-half years. The average duration of symptoms was 6.72 months; in 45.8 per cent of these cases the lymph nodes apparently were not involved.

TREATMENT

There can be no question concerning the value of the use of radium in the treatment of malignancy under certain circumstances, but clearly operable cases should not be treated with radium. All patients whose conditions are inoperable are given radium treatment, or they are directed to take such treatment elsewhere. Many early operable cases are made inoperable by the use of radium. Precancerous conditions should not be treated with radium. We have seen many cases in which the surface area had been scarred over, but the original lesion had become active underneath, eventually culminating in a hopeless condition.

Quick was the first to report a large series of cases, and since many of these are recent, more time must elapse before it can be determined whether or not radium should supplant surgery in the treatment of cancer of the tongue. There is no question concerning the value of radium as a palliative measure, or if surgery is contra-indicated in advanced cases. During the last few years, since the advent of radium, all the surgical patients have had, besides the surgical treatment outlined, radium applications over or into the tongue, and outside of the neck.

RESULTS OF TREATMENT—MAYO CLINIC

From January 1, 1910, to January 1, 1922, 303 patients came to the Clinic because of cancer of the tongue. We considered that the conditions of 185 (61.05 per cent) of these were inoperable, leaving a little less than 40 per cent operable. The variation in statistical results in these cases will be largely due to what one considers operable and inoperable cases. In early cases the patients almost invariably do well; in advanced cases the results are less favorable and yet a certain proportion of patients, even in the late stages, can be cured and should be given the chance. The ultimate results, as a series, should not be compared with the series made up entirely of early cases. Many of the deaths reported were due to other conditions, and, of course, the death rate in persons of these ages is naturally high. Therefore, it is difficult to obtain an accurate estimate of the percentage of cures. The statistics in this paper were estimated according to the reports returned in answer to questionnaires.

Of the 118 operable cases, 52 patients at an average age of 52.32 years, had involved nodes at the time of operation, while in 66 at an average age of 53.41 years, the lymphatics were free. We have recently had reports from nearly 80 per cent of these cases, and find that 30.85 per cent are free from disease more than 3 years; 24.46 per cent more than five years; 7.44 per cent more than 8 years; and 4.25 per cent more than 10 years.

TECHNIQUE

Our operative procedures have varied somewhat during this interval, but the general principles have been much the same. Most of the patients were operated on in two stages, the first stage consisting of removal of the cervical lymph nodes. If these were found to be involved, we have usually performed complete block dissection on the affected side with the removal of the submaxillary and the upper part of the deep cervical glands on the opposite side. If the glands were not involved, we removed the submental, the submaxillary, the upper part of the deep cervical, and the glands situated in front of the internal jugular vein. After these wounds have healed, in a few days to a week, the lesion of the tongue is removed by means of wide excision extending well into normal appearing tissue.

TABLE I.—A STUDY OF THREE HUNDRED AND THREE CASES OF EPITHELIOMA OF THE TONGUE FROM JANUARY 1, 1910, TO JANUARY 1, 1922, SHOWING END-RESULTS

	Total	Per cent	With glandular involvement		Without glandular involvement	
			Cases	Per cent	Cases	Per cent
Three year cures	29	30.85	8	17.62	21	44.68
Five year cures	23	24.46	5	10.63	18	38.29
Eight year cures	7	7.44	0	...	7	14.89
Ten year cures	4	4.25	0	...	4	8.51

TABLE II.—END-RESULTS IN PATIENTS WITH AND WITHOUT GLANDULAR INVOLVEMENT

	With glandular involvement			Without glandular involvement		
	Living	Dead	Total	Living	Dead	Total
Lived less than 1 year	0	19	19	0	7	7
Lived 1 to 2 years	2	4	6	4	5	9
Lived 2 to 3 years	1	4	5	2	2	4
Lived 3 to 4 years	1	2	3	2	1	3
Lived 4 to 5 years	0	0	0	0	0	0
Lived 5 to 6 years	3	0	3	4	1	5
Lived 6 to 7 years	0	1	1	4	0	4
Lived 7 to 8 years	0	0	0	2	0	2
Lived 8 to 9 years	0	1	1	0	1	1
Lived 9 to 10 years	0	0	0	2	0	2
Lived 10 to 11 years	0	0	0	1	0	1
Lived 11 to 12 years	0	0	0	3	0	3
Hospital mortality	0	1	1	0	0	0
Not stated	0	8	8	0	6	6

TABLE III.—PERCENTAGE OF OPERABLE AND INOPERABLE CASES

	Patients	Per cent	Hospital mortality	Per cent
Number	303			
Inoperable	185	61.05		
Operable	118	38.94	1	0.84
Males	101	85.59	1	0.99
Females	17	14.4		
Operable patients with glandular involvement	52	44.06	1	1.92
Operable patients without glandular involvement	66	55.93		
	Males	Per cent	Females	Per cent
Surgical	101	85.59	17	14.4
Inoperable	161	87.02	24	12.97

TABLE IV.—AGE INCIDENCE IN ONE HUNDRED AND EIGHTEEN OPERABLE CASES

Years	With glandular involvement		Without glandular involvement		Total	Per cent
	Patients	Per cent	Patients	Per cent		
30 to 40	5	9.61	9	13.63	14	11.86
40 to 50	18	34.61	16	24.24	34	28.81
50 to 60	13	25.00	18	27.27	31	26.27
60 to 70	15	28.84	15	22.72	30	25.42
70 to 80	1	1.93	8	12.12	9	7.62
Youngest	31 years		Youngest		32 years	
Oldest	71 years		Oldest		75 years	
Average age	52.32 years		Average age		53.41 years	

TABLE V.—FOLLOW-UP RECORD IN ONE HUNDRED AND EIGHTEEN OPERABLE CASES

	Patients	Per cent	Average length of disease, months	Average length of life after operation, months
Traced	94	79.66	14.55	36.07
Living	31	32.97	17.73	63.51
Dead	63	67.02	12.99	18.56
Fifty-two with glandular involvement				
Traced	47	90.38	12.40	21.62
Living	7	14.89	12.14	42.85
Dead	40	85.1	12.44	16.83
Sixty-six without glandular involvement				
Traced	47	71.21	16.79	45.02
Living	24	51.06	19.43	69.54
Dead	23	48.93	13.89	20.50

The functional result is as good in a fairly wide removal as in a lesser one; nothing is added to the operation by being more radical in this step. We prefer to make the excision with the cautery.

Our operative mortality at the clinic has been low, and we believe that this is due first, to the fact that we have not accepted altogether hopeless cases, and second, to the fact that we have performed the operation in two stages.

We have classified the types of treatment for cancer of the tongue as follows: (1) cautery excision, (2) cauterization, (3) excision with the knife, (4) the Kocher operation, and (5) radium locally and removal of the glands. We have not had any experience with the radical cautery operation as performed by Blair, but believe that it is based on sound principles and that it should be used when extensive operation is indicated.

Cautery excision is the type of operation preferred, although in cases of considerable involvement in the floor of the mouth we have sometimes used the Percy cautery. In seven cases we have used radium for the lesion on the tongue and removed the glands. Six of these patients have been traced; only one is living. This is not a fair test of the use of radium, however, since radium was used in

these cases because the local lesion was too extensive to be excised satisfactorily.

We have performed the Kocher operation in six cases, that is, dividing the inferior maxilla in the middle line and removing the floor of the mouth, the tongue and the glands. This type of operation was used in these cases because of the extensive involvement of the tissues in the floor of the mouth. The patients were all operated on a number of years ago. Several of them lived comfortably for a time, but eventually died of recurrences.

CONCLUSIONS

1. A reduction in the number of cases of cancer of the tongue depends on the early recognition and proper treatment of precancerous lesions.

2. Lesions of the tongue, suspected of being malignant, should be excised for diagnosis, and should not be treated locally.

3. Improvement in the end-results of treatment of cancer of the tongue depends on early diagnosis and proper treatment in the early stages of the disease.

4. With our present knowledge, all patients with operable cancers of the tongue should be given the benefit of surgery, including cauterization of the local lesion and excision of the glands of the neck. Radium should also be employed in order to give these patients every possible chance.

CARCINOMA OF THE LIP AND CHEEK

General Principles Involved in Operations and Results Obtained at Presbyterian, Memorial, and Roosevelt Hospitals [1]

By GEORGE EMERSON BREWER, M.D., F.A.C.S., New York

In grouping together cancer of the lip and cancer of the cheek, your committee has assigned to me the task of presenting to you this evening, a brief résumé of our present knowledge of the general behavior of malignant disease arising in these two adjacent areas of mucous membrane. This should include a consideration of the relative frequency of the different types of growth in each; the known facts in regard to their etiology; the development of their operative treatment; and the chances of cure which reasonably may be expected to follow their treatment by modern surgical measures.

Malignant disease in these two areas, situated as they are so closely together that one could with difficulty state where the one ends and the other begins, they nevertheless present such differences in frequency; in clinical progress; in extension to other structures; in accessibility to radical treatment and in ultimate results, that one could almost affirm that in prognosis they represent the two extremes of hope and despair.

As the combined statistics of the Presbyterian, Roosevelt, and General Memorial Hospitals for the past 10 years give only 415 cases of cancer of the lip and cheek, a number far too small for accurate conclusions, the writer has collected reports, more or less complete, from thirty-one surgical clinics, totalling 3,889 cases—11 of these reports were published prior to 1900, 20 since that date.

Cancer of the lip while of fairly frequent occurrence is by no means one of the commonest manifestations of malignant disease. From an analysis of records of hospital admissions, one can state that in from 2 to 3 per cent of cancer subjects seeking treatment, the primary disease is located in the lip. Cancer of the lower lip is about twelve times as frequent as cancer of the upper. In an analysis of lip cancer from five surgical clinics, it was found that of 694 cases, in 637 the disease was primary in the lower, and in 57, the upper lip. In 35 both lips were involved. There is also a very marked difference in regard to sex. About 95 per cent of the cases occurring in males (941 males; 40 females).

These facts strongly incline one to look for some definite etiological factor. The one most frequently mentioned is tobacco smoking. The constant irritation of the formerly much-used clay pipe, with its heat and tendency to

[1] Presented before the Clinical Congress of American College of Surgeons, Boston, October 26, 1922.

adhere to the mucous membrane of the lower lip, was thought by many to be the most important source of lip cancer. More recently José Ribera of Madrid called attention to the constant irritation caused by the almost universal habit among Spanish men of smoking cigarettes and of allowing them to remain in contact with the lip until nearly consumed, as constituting a definite etiological factor.

Louis Bradford Couch, in discussing the subject in 1911, pointed out the three important factors in the relationship between tobacco smoking and lip cancer: first, local anæmia caused by pressure of the pipe stem on the lower lip; second, the irritating effect of nicotine and the products of combustion, carbon monoxide and carbon dioxide making with the water of the mouth secretions carbonic acid; and third, the direct action of heat.

It is an interesting and significant fact, that while cancer of every kind is far less frequent in the colored race, the vital statistics of the District of Columbia show that among deaths of women over 70 years of age, 8.04 per 100,000 of white women die of cancer of the lip, while in negro women, a large proportion of whom smoke clay pipes, the rate is over 30.1. Among other etiological factors may be mentioned seborrhœic keratoses and small papillomata, both of which are not infrequently found on the lower lip; irritation from diseased teeth or badly made plates; cracks from chapped lips; leucoplakia; herpes labialis; minute cuts from the habit of shaving too closely along the muco-cutaneous border; direct blows, or the stings of insects. While these and many other factors often are blamed for the occurrence of cancer, experience teaches that we must regard only the sources of more or less constant irritation, as causative agents here as in cancer elsewhere; and of these smoking, cracks, papillomata, and keratoses undoubtedly are the most important. Of the different types of malignant disease occurring in the lip, only three deserve consideration: (1) squamous epithelioma, (2) basal-cell epithelioma, and (3) sarcoma.

While few of the reports give accurate descriptions of pathological findings, and while even in the best there is a remarkable variation in terms employed to describe the type of neoplasm, still, from the available data, the writer feels justified in stating that fully 95 per cent of malignant tumors of the lip should be classified as squamous epithelioma.

In a series of 333 cases taken from the records of the Presbyterian, Roosevelt, and the General Memorial Hospitals, there were no cases of sarcoma, and but eight cases of basal cell tumor, making the percentage of the latter 2.4 per cent.

Ewing describes two clinical types of epidermoid cancer of the lip, the papillary and the ulcerative infiltrating variety.

The papillary occurs as a wart-like, elevated lesion, situated in or on the epidermis, and for a long period is unaccompanied by deep or subepithelial induration. It extends slowly in all diameters, finally ulcerates, penetrates the underlying tissue, involves the anatomically related lymph nodes, and in the end closely resembles the second or more malignant variety.

The ulcerative infiltrating type begins as a broad thickening of the epidermal layer, with early dense infiltration of the deeper structures, and the formation of a crater-like ulceration surrounded by a definite, indurated border. It advances more rapidly than the papillary type, involves the lymphatic structures earlier, is surrounded by an area of œdema, and not infrequently becomes infected and undergoes extensive necrosis.

While visceral metastases are rarely present in neglected cases of both varieties, they are more frequently encountered in the latter type, and may be found in the mediastinum, liver, lungs, heart, and adrenal glands.

Lymphatic extension in cancer of the lower lip is almost invariably first observed in the submental nodes, from these it extends to the submaxillary group, thence to the upper and, finally, to the lower cervical groups, both superficial and deep.

In cancer of the upper lip, the submental nodes often are not involved, the disease being carried first to the nodes adjacent to the submaxillary salivary gland, or to the upper deep cervical group.

While in the great majority of instances early lymph node metastases occur on the same side as the primary lesion, this is not

always the case, as numerous examples have been reported in which the earliest lymph node involvement occurred on the side opposite to the primary growth.

Judd, in 1908, called attention to the fact that the submucous lymphatics of the lower lip drain into the submental nodes, while the adjacent subcutaneous lymph vessels almost all pass to the nodes surrounding the submaxillary salivary glands. He also stated that while the salivary gland was never actually involved in the early stages of lymphatic metastases, its removal was strongly indicated, for the reason that numerous lymph nodes were in close relation with it and often occupied deep recesses in the gland substance although lying without its capsule.

These views were later confirmed by Beckman, who advocated complete removal of all nodes, lymph-bearing areolar tissue, and the submaxillary glands on both sides; and if disease could be demonstrated in these structures, to make a complete block dissection of the neck on the side of the involvement. This author also stated that he had failed to find evidences of cancer in the lymphatic vessels leading from the primary lesion to the involved nodes, which tends to confirm the view expressed by Ewing, that in this region at least, the lymph node metastasis was an embolic process rather than a direct growth of malignant cells along the lymph channels. If this view is correct it would justify the technique now almost invariably followed by surgeons in early cases, of leaving intact the tissues lying between the operative wound of the primary lesion and the one for the removal of the related lymph nodes beneath the jaw.

In late cases, especially where infection is present, extension of the disease is rapid, the original lesion invading the tissues of the cheek, the chin, the mandible; and the lymphatic metastases spreading to nodes beneath the lower border of the parotid gland, and to the deep cervical chain. Bloodgood states that he has never seen an operative cure if the subparotid nodes were involved, or if the disease had invaded the jaw bone.

Basal-cell epithelioma of the lip is an exceedingly rare affection, and is somewhat more frequent on the upper lip.

In 333 cases of lip cancer from the records of the Presbyterian, Roosevelt, and General Memorial Hospitals, it occurred but eight times; five times in men, and three in women. Five of the eight were on the upper lip, one on the lower, one at the angle of the mouth, and in one instance, the location was not mentioned.

Bloodgood states that the primary lesion always appears on the cutaneous side of the vermillion border. When first observed it is a small slightly elevated, oval, insensitive nodule. This increases in size very slowly, and for a long period remains superficial with but little or no subcutaneous induration. At a later period, the surface of the lesion ulcerates, leaving a superficial erosion, which later is surrounded by a narrow margin of induration. The ulcerated area slowly increases in diameter, the underlying tissues become indurated and on microscopic examination delicate strands of tumor cells are seen to extend outward in the healthy tissues, apparently following or filling the dilated lumina of lymphatic vessels. As in the case of rodent ulcer on other parts of the face, the disease, if untreated, may result in extensive loss of tissue causing great deformity.

This type of epithelioma differs entirely in its clinical manifestations from the squamous-cell variety. It is said never to result in visceral metastases, and very rarely invades the neighboring lymph nodes. In fact, its malignancy is so mild that some authorities fail to place it in the class of malignant neoplasms.

This view the writer feels is untenable for the reason that a number of cases are on record where the microscope has revealed both types of epithelioma in the same tumor; also a number of other cases in which the tumor may be said to occupy a position midway between the typical, mild, basal-cell growth and the frankly malignant squamous variety, in that it shows in places prickle cells; in other places cells from the middle layer of the epidermis, and in still other localities cells from the ducts of the cutaneous glands.

Although it is not the writer's intention in this brief clinical report to discuss at length the many pathological questions which may arise in regard to epidermoid cancer in gen-

eral, it may not be out of place just to mention the painstaking observations which have been made at the Mayo Clinic, with a view to explaining the varying degrees of malignancy clinically observed in different types of squamous-cell cancer of the lip. Broders, from an analysis of 537 cases, divided the cases into four groups, depending chiefly upon the degree of differentiation of the cells and the number of mitotic figures. He demonstrated in Group I, which shows the greatest degree of differentiation but with no mitotic figures, that the cures were 100 per cent, while in Group IV, which shows the opposite microscopic picture, the percentage of cures was reduced to zero.

If these observations are confirmed, in the writer's opinion, they constitute one of the most important contributions to the subject of lip cancer which has appeared in recent times, and may result in definite changes in operative technique.

Sarcoma of the lip is so rare as to constitute a veritable surgical curiosity. Three clinical types are recognized, the hard, slowly growing fibrosarcoma, of feeble malignancy; the soft, rapidly advancing round-cell tumor, and the melanotic variety, the two latter being exceedingly malignant.

While no case of sarcoma of the lip appears in my records of the Presbyterian, Roosevelt, and the General Memorial Hospitals, two cases of fibrosarcoma were observed at the Vanderbilt Clinic, in which the diagnosis was confirmed by microscopic examination after local removal of the lesion, and a few examples of the more malignant varieties are to be found in hospital reports and current literature.

The number of such cases, however, is so small in comparison to the usual type of lip cancer, that they will not receive further attention in this report.

To give one some idea of the relative frequency of malignant and benign tumors of the lip, it may be stated that in a series of 34 lip tumors reported from the Vanderbilt Clinic and the Out-patient Department of the Presbyterian Hospital, there were: 19 epitheliomata, 2 fibrosarcomata, 7 fibromata, 3 papillomata, and 3 composite tumors, the proportion of benign to malignant being 13 to 21.

While all of these innocent tumors should be regarded as possibly precancerous lesions and should be removed, the composite growth, or so-called salivary gland tumors deserve more than a passing mention, as they occur more frequently in the upper lip, and their clinical diagnosis is not always easy.

As is well known, numerous small masses of aberrent salivary gland tissue are constantly found in the lips, lying between the mucous membrane and the orbicularis muscle. It was formerly believed that these small masses gave origin to these composite growths, tumors corresponding in type exactly to the mixed tumors found so frequently in the neighborhood of the parotid and submaxillary glands; and while recent investigation has thrown some doubt upon their exact origin, the fact remains that tumors of this class are not infrequently encountered in the lip. These tumors are at first encapsulated, lie beneath the mucous membrane, but not firmly attached to it. They are oval or irregular in shape, often with varying density owing to the presence of cartilage; fibrous, myxomatous, or glandular tissue. Generally they can be slipped about beneath the mucous membrane by the palpating fingers. They grow slowly, but if untreated may reach a large size causing marked deformity. As is well known, these tumors occasionally undergo malignant change, and it is not improbable that some of the rarer types of malignant tumors of the lip, as the alveolar or myxosarcomata, or some of the atypical examples of epithelioma, may have their origin in a lawless growth of either the connective tissue or epithelial elements of these complex growths.

In the development of the surgery of cancer of the lip, one recognizes several stages as in cancer of other regions. First the period of late diagnosis, and later incomplete local operation; with disastrous results, both immediate and remote, and with practically no permanent cures. Then as a result of earlier diagnosis, earlier operation, and improved technique, a lower operative mortality, and a few permanent cures. Still later when the importance of lymphatic extension began to be recognized, and the involved neighboring

lymph nodes were removed, more permanent cures were reported. Finally, when the regular routes of lymphatic extension were demonstrated; when the anatomically related lymph nodes and lymph-bearing areolar tissues were removed whether involved or not, the percentage of cures rose steadily, due to the thoroughness with which these principles were carried out, and more particularly to the fact that during the past decade, owing to popular education in regard to malignant disease, patients with suspected cancer seek surgical advice earlier, and show less procrastination in accepting operative treatment. Roughly speaking, the first three of these periods occurred prior to 1900, the last since that date, and is at present progressing.

During this early period, a number of carefully prepared reports appeared, which indicated that as a rule only the visibly and palpably diseased tissues were removed; and although the majority of the operations were only V-shaped excisions of the primary growth, the fact that in these reports a fair number of extensive neck and jaw operations were undertaken, would indicate that the operating surgeons were by no means timid in their attacks on late and wide-spread disease.

Thus Woerner, in 1885, reports from the Tuebingen Clinic 350 operations on 277 individuals of which there were 224 simple wedge-shaped excisions of the local lesion; 69 extensive local resections requiring plastic repair; 23 extirpations of the diseased glands; 26 more or less extensive resections of the lower jaw, and 8 of the upper. He further reports that 27 died as a result of the operation; 146 died of recurrence; 80 were living with evident recurrence; and 97 living and well: 89 over 3 years, or 32 per cent three year cures. Toward the end of this period Theodor Fricke, in 1898, reported 124 cases of which 8 died from operation; 33 from recurrence; 4 living with recurrence; 27 died from conditions other than cancer three or more years after operation; and 42 were alive more than three years without evidence or recurrence, making his statistics 55 per cent well at least three years following operation. Woerner collected the statistics from seven additional operators, namely Thiersch, von Bergmann, Billroth, Winiwater, Fischer, Koch, and Partsch, and combining these with his own, and those of Fricke mentioned above, we have 814 cases with 272 three year cures, or about 33 per cent.

These statistics, although they do not give us the percentage of cure in the various types of disease, as regards duration of the process before operation, or the extent of lymph node involvement, give us a fair estimate of the success of the world's best operators prior to 1900, the period before the exact routes of lymphatic extension were accurately known, and before the principle of removing all lymphatic drainage areas whether infected or not was generally adopted. They show moreover a gradual improvement in results from the earliest report of Thiersch in 1865 of 10 per cent three year cures to the latest by Fricke in 1889 of 55 per cent.

Let us now briefly consider the progress in operative technique and results since 1900.

The two most important contributions in the early part of this period were those of Crile to the Southern Surgical and Gynecological Society in 1906, and von Bonsdorff to the International Society of Surgery in Brussels in 1908.

In Crile's paper attention was called to the fact that in less than one per cent of the cases of cancer of the face, head, and neck, were remote visceral metastases found; but that the disease was almost invariably limited to the extensive collar of lymphatics surrounding the neck. He then described his method of block dissection with removal of all lymph nodes and lymph-bearing areolar tissue on one or both sides of the neck, where the upper or primary lymph nodes were involved. He reported that 12 of 46 cases so treated were well and free from recurrence three years after operation. His group included many examples of advanced long standing disease ordinarily regarded as hopeless.

Von Bonsdorff emphasized the fact that Volkmann's rule, that a three year freedom from recurrence constituted a cure in operations for cancer, was no longer tenable; as the statistics of Loos, Steiner, and Janowsky conclusively proved that in cancer of the lip, nearly 10 per cent of the recurrences occurred after

three years; and that a five year period should be the standard. He also described the distribution of the lymph vessels from the lip to the submental, submaxillary, and cervical chains, and advocated wide removal of primary growth without regard to the extent of plastic repair necessary; complete emptying of both submaxillary triangles in every case, and when indicated, complete block dissection on one or both sides of the neck, but without removal of the internal jugular vein and its branches, or of the sternomastoid muscle.

While sufficient time had not elapsed to report on his own cases in which this method had been followed, he reported two small series of cases of Steiner and Armknecht, in which methods similar to his own had been employed, showing in 44 cases of Steiner 70.45 per cent three year cures, and 72 per cent five year cures; and in 19 cases of Armknecht 94.7 per cent three year cures.

At the same meeting Dollenger reported a series of 200 cases of cancer of the lip of which 158 were primary. Late reports on these cases showed 70.7 per cent free from recurrence in three years, and 69.6 per cent five year cures.

A fourth series of 80 cases reported in 1906 by Hallstrom gives the percentage of three year cures as 63.73 per cent.

It will thus be seen that during the first decade of 1900, a marked improvement in results followed the advanced technique employed, the three year cures mounting from 33 per cent to 74 per cent; and two series of five year cures showing an average of 70 per cent.

In reviewing the histories of lip cancer treated in the Presbyterian Hospital and Roosevelt Hospital during the past ten years, the writer was surprised at the small number of cases, and at the comparatively low percentage of late reports.

At the Roosevelt Hospital there were 40 cases: males 36, females 1, sex not recorded 3. Lower lip 30, upper lip 4, both lips involved 1, not stated 5. Squamous-cell epithelioma, 36; basal-cell, 3 (2 males, 1 female); adenocarcinoma, 1; local operations only, 14; local removal and cervical glands on one side, 20; local removal and cervical glands on both sides, 1; glandular removal only, recurrent case, 1; cautery, curettage, X-ray, or radium, 4 cases.

At the Presbyterian Hospital there were 41 cases: males 37, females 4, upper lip 4, lower lip 37. Squamous-cell epithelioma, 38 (upper 37, lower 1); basal-cell epithelioma, 3 (upper 2, lower 1); local operation only, 11; local removal and neck dissection, 29, of which 25 were of the maxillary, submental, and upper cervical nodes; and block dissections, 4.

From the follow-up we find: 1 living 7 years after operation, 2 living 5 years after operation, 2 living 4 to 5 years after operation, 5 living 3 to 4 years after operation, 3 living 2 to 3 years after operation, 6 living 1 to 2 years after operation, and 3 less than one year.

In 17 cases operated upon more than three years ago, the end-results are recorded. Dividing these into three groups, we find that in Group I, local operation only, we have four cases: 1 dead 7 years after operation of recurrence, 1 living 5 years after operation with recurrence, 1 living 3¾ years after operation with recurrence, 1 living 1½ years after operation without recurrence.

This small group illustrates how misleading a three year standard of cure can be, for three of these cases passed the third year limit without recurrence; 2 passed the fourth, and one the fifth; yet all later developed recurrences.

Of 7 cases of Group II, local removal, with extirpation of submental and submaxillary glands—glands negative—all, or 100 per cent, are well and free from recurrence more than three years after operation. 1 more than 5 years, 2 more than 4 years, 4 more than 3 years.

Of 5 cases in Group III, in which glands were involved: 1 is living and well 4 years after operation, 1 is living 2½ years after operation with recurrence, 1 dead 1¾ years after operation with recurrence, 1 living 1½ years after operation with recurrence, 1 dead 9 months after operation with recurrence.

In one case, only the glands were removed, the primary operation six months before. This case had three operations, and was also treated by heat coagulation; died one year after primary operation.

If we except Group II in which we have 100 per cent three year cures, these results are disappointing, and in the writer's opinion are

due to the fact that submaxillary lymph node removal was not done in Group I; and only one block dissection was carried out in Group III.[1]

In 1908 Judd reported in a series of cases at the Mayo Clinic, where it was then the routine to remove the glands from both submaxillary triangles, the result in Group I, the percentage of three year cures was 25. In Group II the percentage was 69 plus.

In 1913 Beckman advocated dissection of both submaxillary triangles, and if involved nodes were found, complete block dissection of the neck on that side, with the result that in: Group I, his reported cures were 73.3 per cent; Group II, his reported cures were 83.8 per cent; Group III, his reported cures were 50 per cent.

In 1914 Bloodgood from an analysis of 200 cases at the Johns Hopkins Hospital, gives the results of cases operated upon more than five years. Group I, 10 cases, 63 per cent cured; Group II, 21 cases, 95 per cent cured; Group III, 6 cases, 50 per cent cured.

In 1921 Sistrunk reports on 136 cases at the Mayo Clinic. All operated upon five years or more before the report. Group I, 27 cases, 70.2 per cent living 5 to 8 years; Group II, 98 cases, 90.3 per cent living from 5 to 8 years; Group III, 11 cases, with block dissection in 6, 18.1 per cent living 5 to 8 years.

I have not attempted to obtain the latest results from the Crile or Mayo Clinics, as they are to be reported separately at this meeting; but comparing the results gleaned from the few selected reports given above with those published prior to 1900, it will be evident to all that great progress has been made.

If we unite the recent statistics of those clinics in which the five year standard has been adopted, and in which the highest type of technical work is being carried out, the following averages will be obtained.

Group I—in which only the primary lesion was removed, 66 per cent well and without evidence of recurrence five or more years.

Group II—in which the primary lesion and the anatomically related submaxillary lymph structures have been removed, but without lymph node involvement—92 per cent five year cures.

Group III—in which the primary lesion and related lymph nodes have been removed, but with positive evidence of involvement of the latter—34 per cent five year cures.

The limited time allotted to this report precluded the possibility of entering into any discussion of the question of recurrent cancer of the lip. The topics of diagnosis and operative technique are also omitted for the same reason, and also for the reason that before an audience such as this, these considerations are obviously unnecessary.

My report on cancer of the cheek will be exceedingly brief. If we exclude the Eastern tropical countries where betel nut chewing is practiced, primary cancer of the cheek may be classed among the rarer manifestations of the disease. Most of the reported cases are combined, either with malignant disease of the face, or of the mouth, and for this reason, accurate statistics are difficult to obtain.

Of 82 cases collected from the histories of the Presbyterian, Roosevelt, and the General Memorial Hospitals, 71 were in males, and 11 in females. Excluding four cases as of doubtful malignancy, and one in which the type was not mentioned, 75 were epidermoid cancer, and 2, basal-cell growths.

Morestin states that the most frequent site of the primary lesion is at or near the angle of the mouth. From there it quickly extends downward and backward, or upward and backward and soon involves the mandible or the upper jaw. In a study of the series mentioned above, it was found that the majority were so extensive that the location of the primary lesion was uncertain; but in 3 cases it was limited to the region near the angle of the mouth; in 8 it involved the alveolar border; in 4 the middle area of the cheek; in 7 the posterior area. In 59 of the cases it was described

[1] Since the above was written, Dr. Charles N. Dowd has kindly furnished me with the follow-up on 9 personal cases operated upon at the Roosevelt and General Memorial Hospitals, more than 3 years ago.

Of these 8 were well more than three years, and one, when last reported, was well one year and two months. Of the 8, well three years or more, one developed a recurrence after four years; and one died of cancer of the stomach six years after the primary operation. Of the remaining 6: One was well and free from recurrence 3 years and 1 month, one was well and free from recurrence 4 years and 7 months, one was well and free from recurrence 4 years and 10 months, one was well and free from recurrence 6 years and 1 month, one was well and free from recurrence 9 years, and one was well and free from recurrence 11 years.

In all of these the primary lesion was removed together with the related lymph nodes in one or both submaxillary triangles, and, when indicated, the upper and lower groups in the cervical chain.

as extensive, involving the jaws, lips, floor of the mouth, tongue, pillar of the fauces or vault of the pharynx. In 12 it had penetrated the cheek and appeared on the skin surface. In 8 cases it was associated with leucoplakia. Thirty-six of the cases could be classed as early (six months or under), 45 as late.

As the great majority of these cases were reported from the General Memorial Hospital, where they were treated with radium, but few radical operations occur in the series.

At the Roosevelt and Presbyterian Hospitals there were 11 cases. Of these 4 were inoperable; and in 7, radical operations were performed. The operations were: 3 radical excisions of the cheek with removal of submaxillary and cervical glands; 2 radical excisions with partial removal of mandible and cervical glands; 1 radical removal of primary growth with cautery. There was one operative death in the series, and no record of cures. J. Collins Warren, in 1908, reported to the International Surgical Association, 9 cases of cancer of the cheek at the Massachusetts General Hospital: 8 of these were operated upon, with two deaths. Of the 8 operations, 3 were local or palliative, and 5 extensive, including removal of the cervical glands, and in two instances, partial removal of the jaw. There were no cures.

Warren quoted Boyd and Unwin as reporting 10 cases. Four of the 10 had very extensive operations involving the jaw. No reported cures.

At the same meeting Morestin emphasized the extreme malignancy of these tumors and reported 25 operations, nearly all involving the jaw, with two well 2 years after operation.

C. G. Davis, in 1915, reported on 49 cases occurring at the Philippine General Hospital during his service in the Army, but was unable to report any permanent cures.

Dollinger reported on 61 cases. Eleven of these were limited to the mucous membrane of the cheek; the others involving other structures. In 26 the end-results were known: 3, three year cures, all in the limited cases. Meller reported 8 cases, with 2 cures, although the time was not stated.

Ribera reported 5 cases, but gave no end-results.

Of 117 operations mentioned above, there were only 3 reported three year cures.

From these scanty reports, I think we can assume that cancer of the cheek is a rare and exceedingly malignant disease, which quickly spreads to the upper and lower jaw, and to adjacent structures of the mouth, with early involvement of the cervical lymphatics. In all but the earliest cases, radical surgical treatment involves an extensive, disfiguring, and dangerous operative procedure, with but little hope of a permanent cure. In fact, I feel that most surgeons of experience will agree with G. B. New of the Mayo Clinic, in his statement that "the type of the disease which is primary in the cheek is exceeded in its malignancy only by melanocarcinoma."

This report would not be complete without a few words in regard to the treatment of these conditions with radium.

Dr. Quick, who is later to discuss these reports, was good enough to place at my disposal an abstract of the histories from the General Memorial Hospital, and while I have no intention of anticipating any remarks he may make, I would like to give a brief summary of the results.

While the earlier reports of the treatment of cancer by radium and other varieties of radiant energy, failed to impress surgeons as to its value in early operable cases, we are all aware that during the past 6 or 8 years, great progress has been made in the technique of these procedures, and in accurately estimating the proper dosage. As a result of much careful study, experimental experience, and painstaking observation, the results now obtained are far in advance of anything hoped for a decade ago.

Of 252 cases of cancer of the lip treated by radium at the General Memorial Hospital during the past 7 years, a large proportion so advanced that they were referred only for palliative treatment; there were 19 three year cures: 2 of these were over 5 years; 6 between 4 and 5 years; 11 between 3 and 4 years.

As only 70 of these cases were treated prior to July 1, 1919, it gives us 27 per cent of three year cures; 14 per cent four year cures; and 11 per cent five year cures.

In the series of cancer of the cheek treated at this hospital, it will be remembered that the great majority, 59 out of 67, were advanced cases involving large areas. In 61 of the 67, the end-results were determined as follows:

	Cases
Dead	15
Unimproved	13
Improved	6
Well 6 months	9
Well 1 year	11
Well 2 years	1
Well 3 years	3
Well 4 years	1
Well 5 years	1
Well 6 years	1

As only 15 cases were treated prior to July 1, 1919, it gives us 6, or 35 per cent three year cures.

This excludes one dead, three years and six months of recurrence, and does not include the four doubtful cases.

From the statistics of this report which I believe to be accurate, it will be seen that the results of surgical treatment of the lip are far superior to those as yet obtained by radium, and that we are not justified at the present time in advising radium treatment in early operable cases. On the other hand, in cancer of the cheek, the results by radium are so evidently in advance of those obtained by operation, that until it can be demonstrated by a series of well observed three or five year cases, that operation gives equally good results, all cancers arising in the mucous membrane of the cheek should be treated by radium.

Discussion

By A. J. OCHSNER, M.D., Chicago

In the discussion of these excellent papers, I can record my experiences as corresponding quite closely with those of the essayists.

Dr. Brewer's statistics are very convincing.

I have strenuously objected to the treatment of epithelioma of the lower lip primarily with radium or X-ray, because the results after excision of a square portion of the lower lip, never a V-shaped excision, and preliminary or subsequent careful treatment with X-ray have been so satisfactory that it has not seemed wise to make a change.

In advanced cancer of the cheek, the plan of surrounding the growth with a row of radium needles 0.5 centimeter from the outer edge of the growth, and later excising with the cautery, seems worth trying, although our cases are not sufficiently numerous, nor of sufficiently long standing to warrant any positive statement. The same treatment seems indicated for advanced cases of cancer of the tongue.

Dr. Judd's conclusions are equally convincing. I wish to emphasize especially the importance of immediate careful treatment of every case of leucoplakia, because this condition is always potentially malignant.

Above all things the use of tobacco in every form, including snuff, must be prohibited permanently. Decayed roots and rough edges of teeth must be removed, cleanliness in the care of the mouth must be insisted upon, and care must be exercised in the selection of clean food. Filth in the mouth seems to favor the development of cancer.

Extreme care must be exercised in differentiating between cancer of the tongue and gumma, tuberculosis, and actinomycosis. In case of doubt the growth should be excised with the electric cautery, never with the knife, and examined microscopically at once.

I agree fully with Dr. Judd's objections to temporizing and to local treatment with nitrate of silver or iodine or other remedies, until secondary involvement of lymph nodes has occurred.

Early diagnosis and radical operation with the cautery should be insisted upon.

In late cases in which the complete removal with the cautery seems impossible, radium needles should be implanted 0.5 centimeter beyond the margin, forming a circle entirely around the growth. X-ray should be applied properly to both sides of the neck and in front. As soon as the patient has recovered from the effects of this treatment, the lingual artery should be ligated, and the entire growth together with 1 centimeter of apparently healthy tissue should be removed with the cautery, and a careful excision of the lymph glands should be made with the electric cautery, the incision in the skin having been made with the knife.

Dr. Crile has covered the treatment of cancer of the jaw very fully. I have made a study of 126 cases of cancer of the jaw which I have operated upon at the Augustana Hospital. This experience has convinced me of the correctness of

the following conclusions which correspond quite closely with those contained in Dr. Crile's paper.

1. We have found that the occurrence of cancer in the jaw is usually preceded by some form of mechanical irritation, trauma, decayed roots of teeth, badly fitting plates or bridges.

2. Inflammation due to filth or infection connected with carious roots seems to precede the cancer infection.

3. The growths are characterized by slowness of invasion of surrounding tissues.

4. They also fail to produce metastases in distant organs.

5. Incomplete operations are followed by immediate recurrence and rapid increase of the growth resulting in death, regardless of future operations or of X-ray and radium treatment.

6. Insufficient radiation seems to have the same harmful effect.

7. We have obtained the best results from very thorough early operation with the cautery iron, destroying the tissues at least 1 centimeter into the apparently perfectly healthy surrounding area. We follow the rule of destroying at the primary operation with the cautery as much tissue as we would naturally expect to destroy after the first recurrence.

The lymph nodes are dissected with the fine knife of the electric cautery. In place of using the chisel and saw for removing bone we use the red hot soldering iron which carries a very intense heat to a much greater depth than the ordinary cautery.

In case it seems advisable we cauterize the bone first, then chisel away the cooked portion and reapply the soldering iron until the desired depth has been reached. A sequestrum will form which will loosen later and can be easily removed.

In all of these operations, the following technique is employed in administering anæsthesia:

Morphia, ¼ grain, and 1/150 grain of atropin are given 1½ hours before anæsthesia is begun, and 1/6 grain morphia and 1/200 grain atropin ½ hour before. Then ether is administered very slowly by the drop method with the patient in the horizontal position until the patient is very deeply anæsthetized.

The head of the table is then elevated to 90° causing anæmia of the brain which prolongs the anæsthesia so that the operation can be completed without any additional anæsthetic.

The atropin prevents the accumulation of mucus in the pharynx and the elevated position of the head together with the use of the cautery reduce hæmorrhage to a minimum.

As soon as the head of the table is lowered, the patient is awake. Since introducing this method 25 years ago, we have had no postoperative pneumonia in these cases.

By VILRAY PAPIN BLAIR, St. Louis

Fifty per cent of all carcinoma of the mouth could be eliminated in the precancerous stage. Half of the remainder could be cured by relatively simple operations if treated when first seen. A certain percentage is deadly from first inception.

The great majority are squamous but basal cell; glandular and metastatic tumors do occur. Location has a bearing on both prognosis and treatment. Lip growths are the most curable while central upper jaw cancers are rarely curable by cutting operations.

Tongue cancers form the basis for the best available statistics. Whitehead reported 3 per cent operative mortality for intra-oral operations and for complicated cases over 44 per cent. In 200 cases Butlin had twenty deaths, but it was 25 per cent where the jaw bone was divided. For the latter part of the series he reported 41.5 per cent cures for 3 years or over.

The statistics of Kocher, Warren, and Loison do not equal these. Dr. Judd's series, the largest to date is remarkable for high percentage of cures and an extremely low operative mortality.

These reports substantiate my own belief that cancer of the mouth is on the average not as deadly as painted. Ordinarily it receives the most inadequate treatment. To treat it first for syphilis and then to cut it out with a half inch margin is still common practice, yet early diagnosis is easily made and on the average it responds well to early surgery. Among my private patients, mostly people who sought medical advice soon after observing the lesion, 64 per cent were very far advanced or inoperable when they first came to me, and I have done very radical operations upon about 80 per cent of this latter group, because it is difficult to pick the incurable case and any procedure that gives a fighting chance is justifiable. The other side of the picture is 100 per cent deaths in the worst form known, but very few ever metastasize below the clavicle.

It is on this advanced type that my report will be based. Including extrinsic carcinomata of the larynx, I have operated upon seventy-three far advanced carcinomata of the mouth in 8 of the past 10 years. This group is made up of combined involvements such as jaw, cheek, and neck; tongue, jaw and pharynx and floor; tongue, pharynx, and larynx; growths with fixed or broken

down neck glands, etc. A number of these were recurrent cases. No basal-cell tumors nor growths requiring simple laryngectomy nor simple amputation of the tongue or lip with gland resection are included in this series. A number had already been considered inoperable. Those that survived the first operation required from 2 to 10 operations before it was considered the greatest removal and best repair had been completed.

The operative mortality (cases dying in hospitals) was 17 cases, 23.5 per cent; 14 of them from bronchopneumonia. Some died after the third or fourth operation and 2 from repair operations. Forty of these cases were operated upon 3 or more years ago and of these eleven or 27.5 per cent were known to be alive and well 3 to 7 years later, nine to be dead of some cause and twenty untraced. More than half of the traced cases of this group were well over 3 years and none of them are known to have since died of carcinoma. Of the cases operated less than 3 years (thirty-three in all), five are known to be well 2.5 years after operation and two alive 2 years and five for over 1 year. The death rate, over 23 per cent, is much too high. Most of these deaths occurred in the unsettled post war period and later reflection convinces me that half the bronchopneumonias should have been prevented. He who heeds Billroth's caution not to suture the floor of the mouth, will seldom see a severe sepsis or a secondary hæmorrhage after a cutting operation, but he who uses the soldering iron on the soft tissues is courting secondary hæmorrhage.

All our well established cases of tongue cancer are by choice operated upon by the suprahyoid approach by which the whole tongue, floor of the mouth, submaxillary and submental glands, parts of fauces, palate or pharynx can be removed in one mass. This gives a higher death rate than the simple intra-oral hemisection but permits of a much wider excision, and strange as it may seem the speech results are better than after the hemisection. There is one physician on whom 7 years ago I removed his whole tongue from the hyoid for a recurrent carcinoma and he has ever since attended his practice and has a speech that is just a little "thick."

Besides ignorance or selfish motives that might actuate a few, the two chief causes that account for failure to make an early diagnosis are: first, a sentimental attitude that leads the physician to regard the lesion as non-malignant until it is proved cancer; second, a misinterpretation of the report of the microscopic findings. If the first consultant would regard every wart, every superficial induration, and every persistent fissure or ulcer as cancer until proved otherwise and would regard with very grave suspicion every negative microscopic diagnosis, or diagnosis of "inflammatory tissue," then the whole chapter of cancer of the mouth could be rewritten in a very much more cheerful tone. Even worse than a failure of diagnosis is the treatment with irritants, insufficient radiation, or inefficient operation. Cancer is best handled as one would treat a skunk—let it alone or kill it quick, only grief can come from irritating it. In planning treatment or forming a prognosis, the age and size of the tumor and the tissues involved should not form the sole basis of judgment. Some of the larger tumors are fenced around by, and composed largely of, inflammatory tissue that long retards gland infection; while some of the small shallow ulcers that look like abrasions of the mucosa are often the most deadly. Except in the upper jaw the primary growth does not early erode the bone, but the secondary growth in a lymph node, usually the buccal gland, will walk through the mandible like a smudge fire in a rotten log. In regard to time, certain growths were beyond help 2 months after they were first noticed while others seemed easily operable 18 months after they first gave symptoms. Recurrent pain radiating to the ear and vertex and the unexplained enlarged node in the adult should always be regarded with cancer suspicion. The primary lesion is not always easy to find. In one of my cases an immense carcinomatous mass in the neck was dependent upon a slight roughness of the uvula that was detected with the finger but hardly visible. Pharyngeal growths often go undetected. In another case a small ulcer on the anterior surface of the epiglottis remained undiscovered for 4 months after it was persistently sought. All associated lymph-bearing areas should be removed in every case. I have seen gland infection become manifest 8 years after cure of primary lip ulcer and a spontaneously cured lip ulcer followed 4 years later by a squamous epithelial infection of a corresponding lymph node.

Within the mouth I use hot cutting cautery, in the neck knife and scissor dissection. Only on bone do I use the soldering iron, and except to make a false joint after cauterizing the pharynx, I no longer resect the jaw for carcinoma.

We have had some remarkable immediate results from radiation and as soon as X-ray or radium is proved to cure cancer of the mouth, I will abandon mutilating operations, but if before that time I should be so unfortunate as to develop one on myself I will seek the man who does the most radical operation.

By DOUGLAS QUICK, M.B., (Tor.) New York

At the Memorial Hospital, our methods of treatment of the diseases under discussion are at present almost diametrically opposed to those already advanced. These methods are the result of gradual study, observation of radium effects, and consequent change of viewpoint during the past 7 or 8 years, until we now give radium, rather than surgery, first place in treatment of the primary lesion and have adopted a conservative rather than radical procedure in dealing with the cervical nodes. While our period of observation is still too brief to make statistics of real value or comparable to surgical statistics, nevertheless, from the gradual accumulation of evidence, we feel justified in our present stand.

We began using radium in the primary growth in hopeless, inoperable cases: as technique improved and experience accumulated, we were able to demonstrate its value sufficiently to warrant using the same methods in operable cases. The results improved just as do surgical results in selecting cases. At present we use radium entirely in the treatment of the primary lesion in the groups under discussion, with two exceptions—in lower jaw cases with secondary bone invasion and in carcinoma of the maxillary antrum with limited or no bone invasion, we advocate a combination of radium and surgery. We feel that our present position is due almost entirely to a radical change in technique made early in 1916. Previous to this period we were using surface applications of filtered radium in various combinations with some results from a palliative standpoint but very little encouragement as far as complete regression of growth was concerned. It was then that the late Dr. H. H. Janeway advanced the method of burying radium emanation directly into tumor tissue and leaving it *in situ*. This method has practically revolutionized all of our radium work. I believe the method is even yet but little understood outside the circle of a few roentgenologists, hence a word of explanation may be in order. Radium element gives off a gas or emanation which is constantly being redeposited on the walls of its container in the form of solids of rapid change, and it is from one of these, radium C, that the radiations of therapeutic value are given. It is possible to separate this radium emanation from the element itself and place it in any type of container desired. This emanation decreases in strength at a fixed rate—approximately 15 per cent per day. It is evident that the total dosage or energy from a given amount of emanation can be calculated once it has been measured against a known radium standard. It is also evident that for practical purposes this emanation will exhaust itself inside of a month. We have taken advantage of these facts and in our physical laboratory prepare fine, thin-walled, capillary glass tubes approximately 3 millimeters by 0.3 millimeters in size, containing radium emanation. These are buried uniformly throughout the growth by means of trocar needles, and left *in situ*.

The advantages of this method are, uniformity of dosage, accuracy and intimacy of application, and utilization of β as well as γ radiation. It affords a very prolonged radiation permitting of greater dosage and is of further value if we concede that the neoplastic cell is more vulnerable at the time of division. We have had practically no trouble from the small glass tube as a foreign body.

This method of burying radium emanation we use almost exclusively in the treatment of carcinoma of the tongue, cheek, and jaws, supplemented in certain cases by external or surface applications of filtered radium. We use it also in the lip for some of the deeply infiltrating growths, but for most part the lip lends itself admirably to external radiation. If proper molds of the lip are made with dental modeling compound, it is possible to make accurate applications to three sides of the lesion. I cannot agree with Dr. Brewer that surgery is preferable to radium in the lip. I believe that with radium, just as with surgery, it is one of our most brilliant groups. Unfortunately, our statistics which Dr. Brewer has referred to, were taken from the earlier advanced cases treated by methods decidedly inferior to those employed at present. I believe that our rather good results in cheek cancer have been due to the fact that we have been able to treat from both sides, that is, emanation buried directly into the growth and heavily filtered radium applied over the cheek, outside, in close proximity to the base of the growth.

Our conservatism in the treatment of cervical nodes is based primarily on two suppositions which are strongly supported by our clinical observations: first, that cervical lymphatics perform a conservative function, which is much more than that of a filter, up to a certain point; and second, that extension of disease to the nodes is embolic. In support of the first supposition we have adequate microscopic evidence of encapsulation of tumor cells by new connective tissue and destruction by active lymphatic infiltration—and we have all seen the rapid recurrences with increased rate of growth once these factors of natural immunity are interfered with. In support of

the second premise we have the conclusions of many workers who have been unable to trace direct extension along the lymphatics from the primary growth to the nearest nodes and the clinical observation that nodal involvement does not occur in sequence. In my own experience I have found the jugular node, at the junction of the submaxillary and upper deep cervical lymph chains, involved much more frequently than any other.

On this basis we decided to leave the neck alone unless a node was palpable or until one became palpable. We then did a unilateral block dissection of the involved side: this was in the earlier part of our work. Our next step was to insert filtered radium in rubber tubing in the wound much as a drainage tube is placed. When we began using radium emanation tubes interstitially we made use of them in our neck work by burying them at any suspicious points in the surgical field and especially at the points where the lymphatic chains were severed. Our results, relative to early recurrences, were noticeably improved. The next step was to select certain cases in which the disease had extended beyond the capsule of the node and in which surgical operability was questionable. In these cases the nodes were exposed surgically, emanation buried uniformly throughout the involved area, and the wound closed. We now have a small group of these interesting cases clinically free from disease beyond the 3 year period. For the past 3 years we have made it a routine procedure to radiate all necks externally either with filtered radium or X-ray, whether nodes were palpably involved or not, and no neck is operated upon, either for removal of nodes or insertion of radium emanation tubes, without preliminary external radiation.

In referring to our statistics I must admit frankly that they are not of sufficient duration to carry much weight. I shall not include any of our recent cases, but will confine my report to the 5 year period—1916 to 1920, inclusive. I must also call attention to the fact that these results have been obtained in an unselected group of cases, most of them well advanced, few surgically operable and many of them hopeless from any standpoint. Our technique in treating these cases was in great part crude and the results do not represent what we feel we can now accomplish.

In the lip group 162 cases were treated and of 115 which we were able to trace 80 were free from disease for an average period of 18 months; of 22 neck dissections done 15 were free from disease for an average period of 18 months.

Of 148 cases of cancer of the tongue, 27 per cent were classed as surgically operable. Of the whole series of 148 cases, 43, or 29 per cent, were clinically free from disease in December, 1920, for an average period of 2 years. In 58 cases neck dissections, plus radiation, were done and 43 were free from disease at that time.

In the lower jaw group we had 69 cases with 13 clinically free from disease for an average period of 2 years, and 14 still improving.

The superior maxillary lesions we have divided into two groups: those beginning in the mucosa over the alveolar ridge and those beginning in the antrum. In the former group we had 44 cases, with 9 free from disease for an average period of 25 months and 5 still improving. Of those arising in the antrum we had 36 cases in all with 8 free from disease for an average period of 27 months and 5 still improving.

We had 44 cases of carcinoma of the mucosa of the cheek with 11 free from disease for an average period of 27 months and 5 still improving.

These statistics were all taken from my radium report made December 31, 1920, and time has not permitted bringing them all accurately up to date. However, in the 21 months which have since elapsed, there has been a marked improvement. This is evident from Dr. Brewer's quotation of our mucosa of the cheek statistics, which give us now 35 per cent clinically free from disease for the 3-year period as against my 25 per cent for a 27-month average period. It is a well established fact that most recurrences are evident during the first year following any method of treatment.

In a general comparison of our results just quoted we have had fewer recurrences in the intervening 21 months from using radium alone on the primary lesion and a combination of radium and surgery in the neck than has been the experience from surgery alone, notwithstanding the fact that we were dealing with an unselected group of cases.

By GEORGE P. MULLER, M.D., Philadelphia

Before we can intelligently determine the proper method of treatment to be pursued in a cancer of the lip, tongue, or mouth we must clearly understand that there are three areas of disease, viz.: (a) the local or primary focus; (b) the paths of permeation and lymphatic radiation and, (c) the temporary depot-like action of the lymph nodes. We must also appreciate that the primary lesion varies in its degree of malignancy as has been well shown by Brœders in his paper published in 1920 in which he grades cancer of the

lip according to the percentage of differentiated and undifferentiated epithelium.

Roughly speaking we must remember that, in cancer of the tongue and floor of the mouth and in cancer of the lip except at the corners, the lymphatic drain trunks overlap to such an extent as to make bilateral metastasis inevitable sooner or later. Furthermore, epithelioma from the mouth tends to remain in the group of lymph nodes receiving the direct drainage for a considerable period of time before invading other groups. And finally, most of these patients die from hæmorrhage, or infection, or from mal-nutrition due to inability to masticate or difficulty in swallowing.

We hear much these days of the failure of surgery to cure these unfortunate people, and I suppose that in the case of the tongue and jaw groups the accusation is a just one, because published statistics usually show a record of cure in only about 15 per cent. On the other hand cancer of the lip, if operated on early, shows a record of cure varying from 70 to 90 per cent. The advanced state of the lesion and the failure of the surgeons to carry out a sufficiently radical excision have no doubt been factors largely responsible for the poor results. The extended use of local anæsthesia and the support given by repeated blood transfusions have eliminated largely the high mortality formerly attendant on very radical surgery of the tongue and mouth.

I would strongly commend to the opponents of surgery certain statements contained in the paper by Frances Carter Wood.[1] We are all interested primarily in the welfare of the cancerous patient and want to offer him that method, be it what it may, which offers the best prospect of a permanent cure. To some extent the patient himself is helping to solve the problem, whether to his weal or his woe, because it is our experience in Philadelphia that cancer of the mouth is now only rarely seen in the surgical clinics except where ligations, biopsies, or measures for the relief of pain are desired by the radiologists. The patients themselves clamor for radium, never for operation.

It seems to me that the patient and the family physician should understand that the suffering and often the mutilation from the use of radium and electrocoagulation is more severe and more extensive than that which follows operation *per se*.

Recently I sent a questionnaire to twenty-five surgeons and seven radiologists in my city and of these twenty-four replied. Only three believe that surgery should be abandoned in the treatment of cancer of the lip. Generally, we practice excision of the lip or tongue cancer when it is early and perform a block dissection of one or both sides of the neck according to the standard surgical technique. All follow up the operation with X-ray treatment. In the case of the upper jaw, most of us prefer to use the cautery during the removal of the jaw. The important point is made by both the radiologists and the surgeons that advanced cases are hopeless and incurable by any method and should be left alone, except in so far as treatment is demanded for relief of pain. We believe that the results of surgical treatment, meaning excision with the knife and block dissection, of cancer of the lip, are every bit as good as those obtained by radiological methods, but I think I interpret the opinion of the majority when I state that the results of surgery in the treatment of cancer of the tongue and jaw are poor. One explanation offered is that the lymphatic drain is so deep in the neck, so far back under the tongue, that surgical removal is not possible.

The radiologists are cautious in making claims but one at least has published his opinion that in cancer of the lip electrocoagulation, radium, and X-rays are much superior to surgical treatment, and I believe that in a short time they will all openly make this statement not only in the case of the lip but also in the case of the tongue, cheek, and perhaps all other cancers. The following statement by Pancoast is a fair one: "If surgical and non-surgical measures offer equally good results in any group of cases, but if one gives better results either as to cures or palliation it should be regarded as the method of choice. Thorough non-surgical technique is every bit as essential as thorough surgical technique."

Wood states regarding operation and radiation: "Each has its rightful place in the treatment of cancer, and by an intelligent combination of operation with radiation better results in the treatment of neoplasms will undoubtedly be obtained in the near future. But at the present moment we are still far from having any very effective control over the cancer situation." I notice in the replies to my questionnaire, that most of us draw a distinction between "early" and "late" cases and all relegate the latter to the radiologist. Now if radium and X-ray, properly used, are superior to excision they should supersede it; if inferior, why subject these patients with advanced lesions to the expense and suffering entailed by radium applications? As for electrocoagulation I fail to see that it offers anything over the ordinary cautery except in cancer far back in the mouth, and I would welcome the opportunity to check up the end-results of many

[1] Long Island M. J., 1922, xvi, 258.

of the case reports from Philadelphia. It is proper to remark that in hospitals where no radium and rather limited X-ray facilities are available, the surgeons are mostly committed to operative treatment.

At the present time, influenced to a great extent by the work of Pancoast, I believe that cancer of the lip and mouth should be treated by a combination of X-ray, radium, and operative surgery. The primary lesion should be treated by surface radium radiation and later destruction by the knife or cautery in the case of the lip, or by bare radiation emanation tubes, cautery, or electrocoagulation in the case of the tongue or mouth. At the appropriate time a complete block dissection of the neck should be performed in the case of carcinoma of the tongue, and a partial excision in the case of carcinoma of the lip. If it is intended to use electrocoagulation in the treatment of the primary lesion, this may be done at the time of the dissection in order to allow of the ligation of the blood supply. I do not ligate the external carotid, believing that the danger of hæmorrhage from cutting by the ligature is great, but prefer to ligate the lingual, facial, and internal maxillary branches. After the neck is healed, postoperative radiation should follow and be continued on the slightest evidence of recurrence. At the time of the block dissection of the neck, it is best to practice radium implantation at the well known areas of frequent recurrence. I do not use the knife on the primary focus except in the case of small, early lesions of the lip, and it may be that I will some time abandon operative measures entirely and advise all of my patients to have radium or X-ray treatment only, of the lymphatic areas in the neck, but so far I have not been convinced that such measures can take care of the growth.

The common practice of some radiologists in reporting cures 8 or 10 months after treatment, with pictures of the patient before and after, cannot be too strongly condemned. No operating surgeon considers such cases cured for at least 3 years and usually 5 years from the time of operation, and the same rule should be followed by the radiologist. I would commend to all of them the excellent "form" used by Greenough of Boston.

By CHANNING C. SIMMONS, M.D., Boston

As a basis for the following remarks I have reviewed the 651 cases of cancer of the buccal mucosa observed at the Collis P. Huntington Memorial Hospital during the past 5 years and analyzed the 186 cases of cancer of the tongue seen in the 3 year period, 1918 to 1920 inclusive.

The hospital was founded for the study of cancer and is the only institution in this community that has any large quantity of radium which is employed for treatment in the form of emanation. Most of the cases seen are of the advanced type or hopeless postoperative recurrences but we are now beginning to see more early cases in consultation. The policy is to consider that all cases are seen in consultation with their physician and treatment advised — not necessarily radium if it is not considered indicated.

The outstanding feature in the histories of these cases was the relation of chronic irritation to the disease as a predisposing cause. Bad teeth, either poorly cared for, or decayed were almost universal. The majority of the patients smoked while some chewed. Two cases occurred in men who were in the habit of holding nails in the mouth. Leucoplakia was common but the Wassermann was positive in only 14 per cent of the cases.

Cancer of the buccal mucosa is a rapidly growing form of the disease, and the cases are often hopeless as regards cure within 2 months from the onset. The average delay on the part of the patient from the onset of symptoms to the first consultation with a physician was 1.9 months, and 72 (39.8 per cent) are definitely known to have received poor advice from the first physician or dentist consulted, the dentists being the worst offenders.

Pathologically three types are seen. The common form is the rapidly growing squamous cell cancer which forms metastases early, although rarely below the clavicle. A papillary form of squamous cell cancer is seen which is of much slower growth and forms metastases late. A basal cell type of cancer is rarely seen.

We have practically come to consider any ulcer of the tongue as cancer until proved otherwise. Complete excision with cautery of small ulcers of the tongue, which do not disappear promptly on removing a possible cause, is a simple matter and the results are uniformly good. If cancer is not present we have at least removed a precancerous lesion. A few cases of tuberculosis of the tongue, a condition closely resembling cancer, are seen at the clinic every year. These ulcers are almost always painful and usually secondary to tuberculosis elsewhere in the respiratory tract. Excision is the proper procedure. If a patient has a suspicious growth on the tongue and a positive Wassermann, appropriate antisyphilitic treatment is given but the tongue lesion is treated as

malignant since the two diseases may exist together in the tongue and much time may be lost waiting to observe the therapeutic effect of the treatment. In all cases of leucoplakia the mouth should be kept free from irritation. The teeth should be cared for, tobacco in any form prohibited, and the patient kept under observation as these cases are very apt to develop cancer.

TREATMENT

We have been disappointed in the results obtained by the use of radium as a curative agent and do not advise its use in early cases. Of 21 cases of what might be termed early cancer treated with radium, two are living without evidence of disease over three years. In one the growth was small and of the papillary type. The second case was a small post-operative recurrence and it was necessary to keep the patient under morphine for six weeks on account of pain due to the radium reaction. I feel that the same results could have been obtained in a shorter time with the cautery with much less pain and discomfort.

In palliative treatment, radium is a very useful agent. It is usually employed as "seeds," that is glass tubes 1 by 2 millimeters in diameter containing from 1 to 5 millicuries of radium emanation. The seed is introduced into the center of the growth by means of a hollow needle, where it remains, and from each seed of 1 millicurie strength introduced the patient receives 132 millicurie hours treatment before the emanation disintegrates. The results of treatment by this method are much better than by the application of the radium to the surface of the growth. In 85 per cent of the cases treated by the seed implantation method the rapidity of the growth was delayed and the patient's life obviously prolonged. Of the cases treated by the application of radium in a container to the surface of the growth 54 per cent showed improvement.

In all cases in which there is a possibility of cure, we are advising radical operation done in two stages. The local growth is removed with the knife and cautery and ten days later a radical unilateral neck dissection is done. By radical dissection I mean removal of the internal jugular vein, the sternomastoid muscle and all lymphadenoid tissue from the clavicle to the base of the tongue. A partial dissection may not remove all the disease and by disseminating the cells hastens the fatal outcome. If the growth is in the midline, bilateral neck dissection is advised. For cautery I have been in the habit of using jeweler's soldering irons and find them more satisfactory than the cautery knife.

Our routine method of treatment may be summarized as follows:

1. Very early or precancerous cases — intrabuccal local excision of the growth with cauterization of the wound.

2. Early cases without fixation — excision of the local growth and cauterization, and ten days later radical neck dissection followed by post-operative X-ray treatment.

3. *a*, Early cases in which the condition of the patient does not warrant the radical operation; *b*, cases of the papillary type; *c*, advanced cases in which the chance for permanent cure is remote but in which the local growth may be entirely removed — excision of the local growth by the knife and cautery and X-ray treatment to the glandular areas of the neck. This operation can be done with little shock and under local anæsthesia in many instances. In studying the records I find that of 18 cases in this group which were operated upon more than 2 years ago, nine are living at the present time and they without evidence of disease.

4. *a*, Cases in which the local growth cannot be entirely removed; *b*, cases with definite metastatic glands; *c*, recurrent cases — radium treatment by the seed insertion method of the growth in the mouth and X-ray treatment of the glands in the neck.

Lip. We believe that operation is the treatment of choice in practically all cases of carcinoma of the lip and do not employ radium. The local growth can be removed surgically, under local anæsthesia if necessary, more quickly and with less discomfort to the patient than by radium. We advise removal of the glands from one or both sides of the neck, depending on the location of the tumor, in every case. We do not advise the radical complete neck dissection as in tongue cases but are content to remove, in one piece, the glands in the submental and submaxillary spaces, and carry the dissection to the bifurcation of the carotid.

I believe that lower mortality from cancer of the buccal mucosa and better operative results will come more from the early recognition of the disease and prompt adequate treatment than from any improvement in our methods.

POLYCYSTIC KIDNEY

By R. H. CRAWFORD, B.S., M.D., F.A.C.S., Rutherfordton, North Carolina
Rutherford Hospital

MY interest and concern in the condition of polycystic kidney was aroused anew when there appeared at the Rutherford Hospital last fall a strong, healthy looking young man complaining of "blood in his urine and a fullness in his abdomen." While obtaining the family history the writer was amazed at the frequency in which the condition had occurred in various members of the patient's family.

Examination showed a robust young man, 34 years of age, a dentist by profession. He stated that for a number of years he was conscious of the fact that he had an abdominal tumor which increased slowly in size and that at varying intervals he noticed blood in his urine. The abdomen was markedly distended by a huge mass extending well down into the loins on the two sides—almost the entire abdomen was filled with the hard, firm tumor formation. By careful palpation one could distinguish two tumor masses practically meeting in the mid-line of the abdomen. The surface of the tumors was irregular, nodular, but compressible. It appeared certain to the writer that he was dealing with a large bilateral kidney tumor—the exact nature of which could not be determined at preliminary examination. Bilateral polycystic kidney was suspected and a painstaking family history was obtained. The patient stated that a number of his brothers and sisters were affected with the same condition and he would have them come in for examination. With the aid of several members of the patient's family, a complete history was obtained extending back for four generations. The origin of the family in America dates back to the time when four brothers from England emigrated to this country. One brother—B. N.—married and had six children. The four brothers lived to be old men and the causative factor of their deaths is unknown. One of the six children, a son, John N., married and was the father of twelve children. He died supposedly of "alcoholism" but lived to an old age as did his brothers and sisters. One of the twelve children—Ben N.—died at 77 years of age, apparently from an abdominal tumor. A sister died of dropsy; a brother was killed in the Civil War; another brother was drowned, while the cause of death in the others is unknown. Ben N. (mentioned above) is the first member of the family in which the condition of cystic kidney presents itself so far as known. He married and had seven children. One, a daughter Sara, was explored and a diagnosis of polycystic kidney confirmed; she is living at 74 years of age. Three children of the seven died in uræmia following polycystic kidney. Each of the four with polycystic kidney married and the same condition appeared in their offspring in one or more instances and in the grandchildren in two cases. One of the four, J. N., married and had nine children. His wife, the mother of my patient, is living and well at 60. J. N. was examined at the Rutherford Hospital in 1916 and a diagnosis of polycystic kidney made. He has since died. Eight of the nine children are living, one died at 13 with typhoid fever. The eldest is 43 and the youngest 20. Seven of these have been examined by the writer and six have easily palpable kidney tumors. The youngest apparently has no kidney involvement. D. N., age 38, was explored in 1916, and a diagnosis of polycystic kidney confirmed.

O. N. had a nephrectomy, left, performed in 1910, and at the present time there is a large tumor mass of the right kidney.

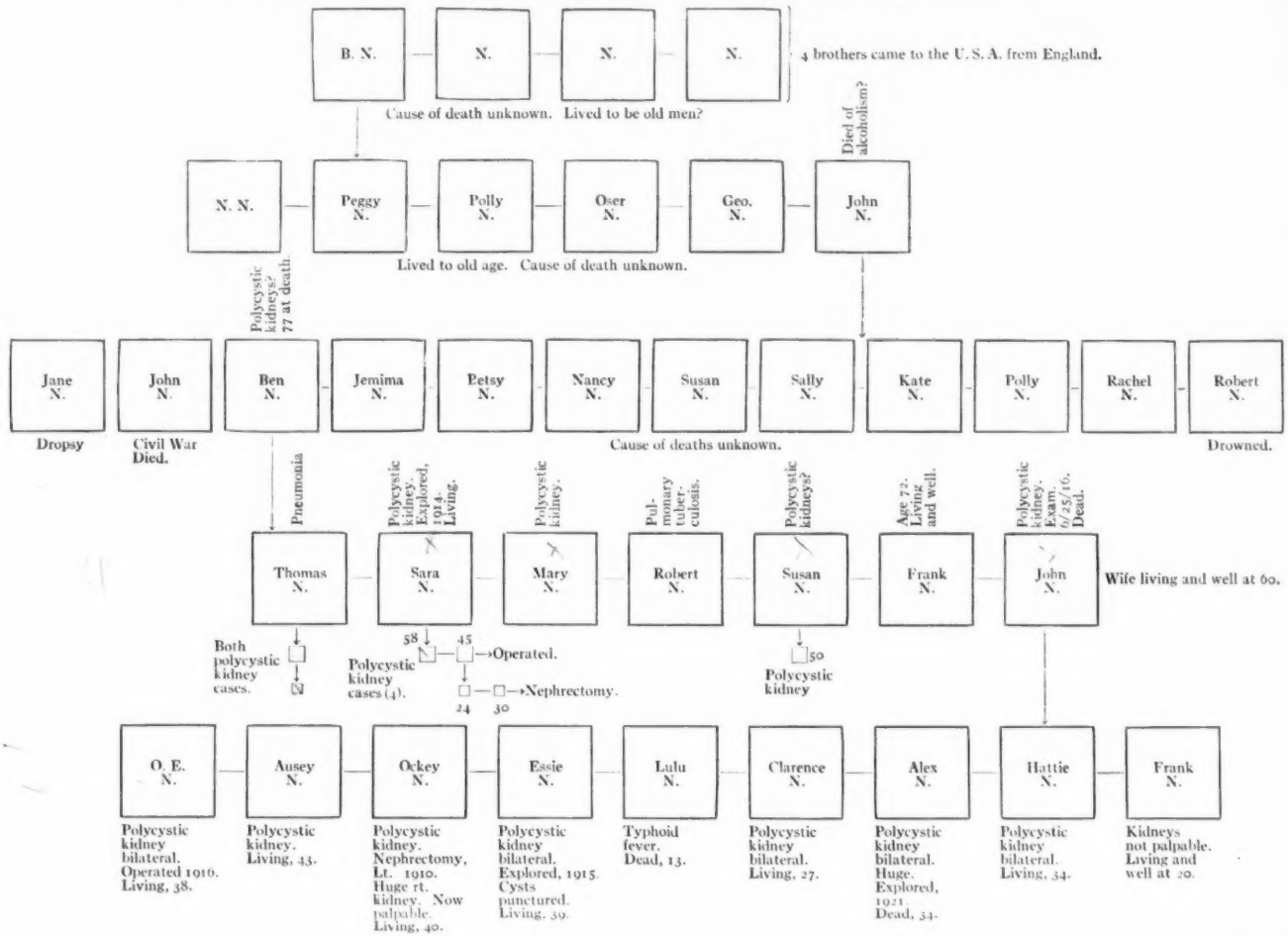
E. N. has a huge bilateral enlargement of the kidney. She was operated in 1915, and the cysts were opened and drained. Out of a family of nine children, seven have easily palpable kidney tumors. In three of the cases the tumors can be readily detected through the clothing.

The urinary findings in my patient, A. N., admitted to the hospital, revealed a few red blood cells, numerous white blood cells, and a good trace of albumin. A diagnosis of bilateral polycystic kidney was made. The patient was very anxious that something be done to relieve the sense of fullness and discomfort in his abdomen and the hæmaturia which interfered with his usual efficiency. Following the technique of Hagner, an exploratory incision and puncture of the cysts was advised and accepted. Under novocaine anæsthesia, a left rectus incision was made over the larger of the two masses. Two huge polycystic kidney tumors were found practically meeting in the mid-line of the abdomen and extending well down into the groin on the two sides. The cysts varied in size from a marble to an orange. A large cyst in the left kidney tumor was aspirated, and the fluid content was of a clear amber color. The incision healed *per primam*, but patient became weaker after operation and 2 weeks after return home died of uræmia.

In 1902, Osler recorded the fact that the condition occurred repeatedly in a family under his observation. Borelius,[1] of Stockholm, describes three cases in the same fam-

[1] Nord. med. Ark.

HISTORY OF N. FAMILY OF NORTH CAROLINA WITH REFERENCE TO POLYCYSTIC KIDNEY



ily: father, son, and nephew. He believes that all cases are hereditary. J. K. Love and Richmond report two cystic kidneys removed post mortem from a patient in whose family this peculiarity had repeatedly occurred. Flintermann describes the same condition in two sisters confirmed by autopsy findings.

The condition is comparatively rare. Preitz's records of Kiel Institute found among 10,000 autopsies only 16 cases. Garceau found 10 cases in 2,429 autopsy records of the Boston City Hospital. Sieber,[1] in a series of 198 collected cases, found 116 females and 82 males. The majority of these cases occurred between ages of 40 and 60.

Luzzato,[2] in 226 cases, found that 185 were bilateral. Sieber, in his report of 150 autopsy records, found that 140 were bilateral, that the disease is nearly always bilateral is well illustrated by its almost invariable recurrence in the opposite kidney after nephrectomy. Sieber noted in 39 cases of his series that cysts of the liver accompanied cystic kidneys.

Numerous theories have been advocated as to the pathogenesis of the condition. I shall mention three well known theories: (1) embryonic, (2) new-growth, (3) inflammatory.

1. Huber[3] states that in embryonic development, a perfect union of the tubules has failed. The idea advocated by Shattuck and Bland-Sutton is in brief essentially that the wolffian bodies and the kidneys which in normal circumstances are distinct become blended and through this failure of differentiation an abnormal kidney results with cystic formation. In fœtal and infant cases numerous malformations occur accompanying the cystic kidneys such as hare-lip, supernumerary fingers or toes, club feet, etc.

2. The theory that they are true new-growths strongly supported by C. Nauwerck and K. Hufschmid[4] is not held today. Malassoz first conceived the theory of new-growth, but Brigidi and Severi believed that the cyst contents were nothing more than the protoplasm of the epithelial cells fused together. They thought they could observe nuclear division of the cells and compared the affection to ovarian cystoma.

3. Virchow believed that the cysts were true retention cysts and that they resulted from occlusion of the urinary tubules in consequence of inflammation of the interstitial tissue in the papillæ of the kidney, a view now entirely abandoned.

[1] Sieber. Deutsche Ztschr. f. Chir., 1905, lxxix, 469.
[2] Luzzato. La degenerazione cistica dei reni. Venezia, 1900.
[3] Huber, G. C. Am. J. Anat., 1904–5, iv, 17.
[4] Nauwerck and Hufschmid. Beitr. z. path. Anat. u. z. allg. Path., 93, xii, 19.

SYMPTOMS

It is passing strange that many of these cases may go to the third or fourth decade without appreciable symptoms. Their attention may first be arrested by fullness and hardness in the abdomen. Others feel a sense of weight in the loins and complain of pain of varying character, perhaps renal colic at intervals. Hæmaturia occurs at irregular intervals and may clear up in a few days' time or less, only to start again at a later date. The hæmaturia is probably caused by rupture of a cyst with bloody serum. A disturbing symptom is frequent urination with a total output for 24 hours larger than normal. In the later stages, there are constitutional disturbances due to nephritis followed by gastric disorders and loss of weight. Usually there is secondary cardiac hypertrophy along with arteriosclerosis. A severe anæmia may intervene, and with generally failing health the patient becomes progressively worse and dies of uræmia.

DIAGNOSIS

Tumor formation is present in one or both flanks having contour of kidney. If both kidneys are involved polycystic kidney is almost certain as this is practically the only tumor of the kidney regularly of bilateral character. The tumors may obtain large size without any symptom. The tumors appear to grow anteroposteriorly but are irregular and nodular. The tumors extend well down into the flank on the two sides and may meet in the mid-line of the abdomen. The urinary findings may be negative but often contain red blood cells, white blood cells, and albumin.

Differentiation between hydronephrosis, pyonephrosis, and hypernephroma can usu-

ally be made by ureteral catheterization. Functional tests of the kidney are helpful to determine the amount of tissue destruction in the kidneys, etc. The cysts are packed closely together and invade every portion of the kidney substance. The walls of the cysts are usually very thin and inside of them are sometimes seen the remains of septa which mark the places of coalescence of neighboring cysts. The fluid content appears in a variety of colors.

PROGNOSIS

The patients are poor operative risks if any such procedure is contemplated. Hagner, Lund, and Rovsing report a series of cases in which the cysts were punctured and drained. The size of the tumors was decreased and patients made more comfortable temporarily. Nephrectomy has been performed many times when the remaining kidney appeared normal—but invariably a few years later the remaining kidney would become cystic also.

Many patients live to a ripe old age without treatment—the majority, however, die about the fourth decade.

SUMMARY

Polycystic kidney is congenital and practically always bilateral. Cysts of the liver may accompany the condition. In fœtal and infant life hare-lip, supernumerary fingers or toes, club feet, etc., may be present along with cystic kidneys.

Heredity plays an important rôle and from my series of cases I venture the opinion that it is a familial affection.

Surgical interference may be adopted—the cysts opened and drained with temporary relief to the patient. Nephrectomy is not indicated even though one kidney appears normal, because the remaining kidney almost invariably becomes cystic.

The patients are poor operative risks. The majority of them live to the third or fourth decade and many have no symptoms other than a sense of fullness and hardness in the abdomen. The tumors are slowly growing formations and are rarely seen between infancy and 18 years of age.

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LEUCOPLAKIA OF THE RENAL PELVIS

By R. E. CUMMING, M.D., Detroit, Michigan

THE leucoplakial conditions of the urinary tract have received relatively little attention in America prior to 1920. During that year, two excellent articles appeared. Kretschmer (1) reporting a case of bladder and ureter involvement, gives also an admirable résumé of all the literature bearing upon the subject. Richey (2) reported leucoplakia in the pelvis of a kidney removed for another condition.

Earlier authors are inclined to consider leucoplakia more frequent than is commonly thought; scarcity of case records certainly indicates an extreme rarity. Kretschmer collected 44 cases, after a careful search of all available literature. He added his own case. With Richey's case and that of our own there are 46 reported cases. The latter named author states that Rokitanski, Orth, and Pollack have also reported leucoplakia, making a possible total of 49 cases.

It should be recalled that the buccal mucous membranes, including the tongue and the œsophagus commonly show the pathology, with an almost undeniable relation to syphilis, alcoholism, and irritation from smoking. Leucoplakia is much more common in the bladder than in the kidney pelvis; the ureter has not been heretofore considered singly as a locus. Of the 49 cases referred to the sites were: bladder, 27; ureter, 5; pelvis, 15; mixed, 7; and undetermined, 3. Of the mixed cases, the kidney and ureter were more often involved together. The smaller number of reported renal pelvis involvements may be based upon the assumption that the bladder diagnoses were made usually *in vivo* by means of cystoscopic examinations, while the kidneys and ureters were recognized as guilty at operation or necropsy with only a few exceptions.

While the contention that leucoplakia is not so rare as generally assumed, is a sound one, we are forced to consider the fact that routine autopsies are becoming the order of the day even in America, and that universally the kidneys are removed for examination whether a complete postmortem study is made or only suspected parts secured. Many writers, prolific on other urological entities and having vast diagnostic and surgical experiences, dismiss leucoplakia with the statement that it is very rare as urinary tract pathology. Keyes (7) states that he has not seen the condition in the renal pelvis.

The abridged case history following will invite a later discussion:

Mr. C. S., age 28, white, a discharged soldier, was admitted to Walter Reed Hospital October 19, 1920. The family and previous personal data are unimportant. The patient denied venereal disease. He had formerly used whiskey moderately and was an inveterate cigarette smoker. His complaints were: (a) pain in perineum, (b) inability to retain urine, (c) blood and pus in urine, (d) painful micturition, and (e) stiffness of neck.

Onset and course leading up to present hospital admission. In February, 1919, while on duty in France, he went on sick report with rheumatism involving neck muscles, left hand, left ankle, and both knees. As the acute symptoms subsided, a stiffness of the neck became apparent, also stiffness of the left hand and the left ankle. At this time the bladder symptoms began, notably frequent burning urination, with severe urgency. A little later blood and pus appeared and at no time since has the urine been clear. He was evacuated from France and after a few weeks in hospitals on this side was discharged unimproved, at his own request. At home, finding himself unable to work on account of the bladder disability, he reported to the Bureau of War Risk Insurance, and was sent to a hospital in West Virginia. At this time he suffered a great deal with pain in the perineum, constant aching pain, with occasional attacks of sharp stabs radiating to penis and left testicle. A suprapubic cystotomy was performed and a stone, about 4 centimeters in diameter, was removed from the bladder. He then improved somewhat, although the bladder symptoms recurred as soon as the wound healed. After more than a year's sojourn in this hospital, he was transferred to the Walter Reed Hospital.

Physical examination. The patient was a small man, fairly well-nourished. Weight 138 pounds—normal 150 pounds. Eyes, ears, nose, and mouth were negative. (Later detailed examination failed to incriminate teeth or tonsils.) There was a tonic spasm of the sternocleidomastoideus and upper fibers of the trapezius on the right side; the former muscle stood out prominently, and appeared hyper-

Fig. 1. Photograph of gross specimen, split so as to show cavern of thickened pelvis. Note also thickening of calyces with typical "scrotal" wrinkling; the contractions of the surface with total loss of cortex in such areas; the deformed arrangement of the pyramids; the area from which blocks were made for section.

trophied, while its fellow was atrophic. The head was rotated to the right with chin up. No tenderness was found in neck muscles; no facial asymmetry. Chest was large, square type; lungs clear. The vascular system was negative. Both epitroclear glands were palpable as were the inguinal glands. There was limitation of motion in the ring finger of the left hand and tenderness in the left ankle. Abdominal examination was negative except for suprapubic scar.

Genito-urinary system: The suprapubic scar evidenced quick healing, was not tender. The prepuce was long but free, the meatus quite small. Prostate symmetrically enlarged, nodular and boggy, distinctly tender, seminal vesicles not palpable. No pain or tenderness was elicited in the perineum along the course of the ureters or over the renal fossæ. Urine October 20, 1920, was pale, cloudy, with albumin and pus, specific gravity 1010, no bacteria.

Wassermann test, October 20, 1920, was negative. Blood count, October 20, 1920: red corpuscles, 4,200,000; white corpuscles, 13,000; hæmoglobin, 70 per cent; polymorphonuclears, 82 per cent.

For 20 days the patient was kept in a medical ward for observation. Further urinalyses showed positive occult blood tests, with microscopic findings of many pus cells and squamous epithelial cells. On November 8, 1920, he was referred to the urological section and accepted for treatment. Further investigation included:

Roentgen-ray examination made by Capt. M. C. Sosman who reported negative fluoroscopic and plate findings for the genito-urinary tract.

Cystoscopy, November 19, 1920. Bladder capacity 100 cubic centimeters. Mucosa showed general chronic cystitis, with a large ulcerated area involving mid-portion of trigone and including the region surrounding the left ureteral orifice. There was no evidence of growth, calculus, or diverticulum. The ulcerated area bled freely upon the least manipulation. The right ureteral orifice was freely patent and admitted a catheter readily. The urine obtained was clear. The left orifice was difficult to find and did not admit a catheter of any size. The patient was very nervous on the table, and complained bitterly of more than 50 cubic centimeter distention. A second cystoscopy was performed November 26, 1920. At this time the left ureter was catheterized a short distance and a specimen of bloody urine obtained. A differential function study demonstrated no immediate or remote excretion from the left kidney while the dye appeared promptly and in abundance from the right. Ureteral specimens: Right—clear, practically no sediment, negative to smear and culture. Left—bloody; sediment contained many leucocytes as well as blood, but no epithelium, bacteria, crystals, or casts. Cultures were also negative. Animal inoculation tests were made with separate urines, but the animals died within too short a period to be of value. No tuberculosis was demonstrated.

Examination of urine for tubercle bacilli. Thirteen consecutive 24-hour urine specimens were examined with negative results. At no examination were other bacteria demonstrated in any considerable numbers. Squamous epithelium persisted along with pus cells and occasionally blood. Cultural reports were all negative.

Gross phenolsulphonephthalein output as tested December 3, 1920, was: first hour and 10 minutes, 25 per cent; second hour, 12½ per cent: total function, 37½ per cent.

During this period use of weak silver nitrate solution and of argyrol indicated a marked bladder intolerance for these solutions. The average daily output of urine was 1680 cubic centimeters. In spite of the failure to demonstrate the bacillus of Koch, a diagnosis of left renal tuberculosis was recorded.

Operation, nephrectomy, December 7, 1920. Gas-oxygen anæsthesia. The left kidney and upper ureter were exposed through a lumbar incision. The perirenal fat was replaced largely by fibrosis, evidencing old cortical or paranephric infection. Some difficulty was experienced freeing the kidney and later separating the pelvis from the vascular pedicle. The surface of the kidney was mottled and irregular, the capsule stripped off with difficulty leaving the kidney of an uneven color. The pelvis was firm and distended, somewhat dilated. The ureter was slightly dilated in its upper 5 or 6 centimeters. On splitting the kidney into halves on its

long axis, the cortex and medulla seemed surprisingly free of disease, while the pelvis and calyces, dilated, were stuffed snugly with a dry crumbly substance, consisting largely of flakes the size of a particle of rolled oats. In color this substance was grayish-brown. There were no calcareous deposits. Upon removing the material free in the pelvis, more of it was found clinging to the pelvic wall and this in turn, was found to be markedly thickened. We estimated that at least two tablespoonfuls of the débris was removed, leaving a considerable amount attached to the pelvis.

Pathologist's report. Major Paul A. Schule examined the kidney and ureter. Gross specimen: weight 154 grams. Capsule is contracted at several points; the pelvis is lined with a dry scaly material resembling bran. Microscopic examination showed marked inflammatory changes of glomeruli and capsules of same, indicated by hyaline change and endothelial proliferation. The tubules of the cortex also showed change, and granular and swollen epithelium. The pelvis shows most extensive lesions; the lining epithelium is not of the usual transitional type. Instead, it is thicker, and of the distinct squamous epithelium type. In addition there is a heavy layer of keratin, densely packed, at least as thick as the epithelial layer itself. Further, beyond the keratin layer, is an even thicker layer of keratin flakes, loosely arranged. These flakes are what was described in the gross as a "bran-like" substance. *Beneath the epithelium*, there is a varying amount of loose œdematous connective tissue, and beneath this in turn, fibrosis, with extensive small cell infiltration, and dilatation of the collecting tubules.

The condition of the pelvis as described, is probably the primary lesion, and presents a definite example of *leucoplakia of the renal pelvis*. The sequel was a glomerular and tubular nephritis, with dilatation of the collecting tubules. No evidence of tuberculosis or active infectious nephritis.

It is scarcely necessary to say that at operation nephrectomy seemed the only wise procedure. The clinical postoperative course included several interesting events. On December 18, 1920, 11 days after nephrectomy, the patient suddenly developed a high fever with an increased pulse rate; physical and roentgen-ray examinations demonstrated a right lobar pneumonia. Daily leucocyte counts were made; their range was from 36,000 downward as the disease retrogressed by lysis, to 17,000 on December 23, 1920. On that date the roentgen-ray also indicated rapid resolution. During the pneumonia, the patient could not be restrained as he did not feel at all sick. His blood non-protein nitrogen did not increase above 52 milligrams per 100 cubic centimeters plasma.

All the urine was saved in 24 hour specimens, for 3 weeks. Whereas during the pre-operative study the urine output averaged 1680 cubic centimeters, during the postoperative collection the average was 1250 cubic centimeters. During the pneumonitis the output was lowered to 500 cubic centimeters, perhaps accounting for the lower average.

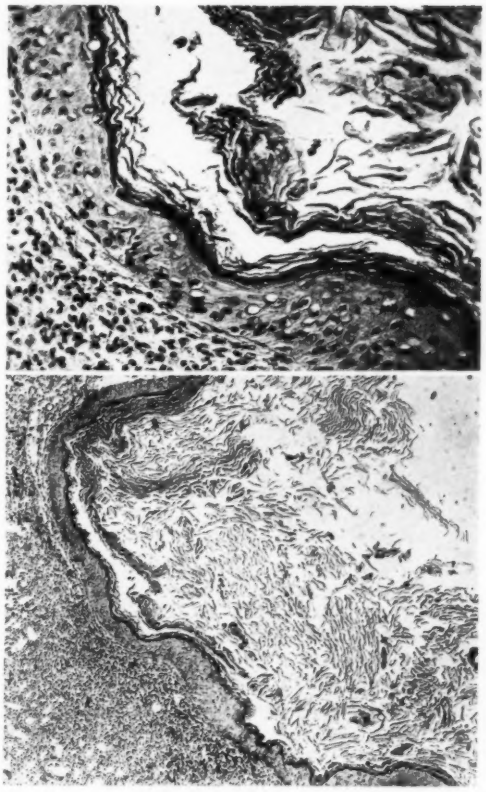

Fig. 2. Microphotograph of a section of the pelvis; in low power photograph note the general arrangement of stratified epithelium, and the enormous amount of keratin loosely attached. In the high power photograph the finer changes can be seen; individual cells lost in the process of keratinization. Submucous round-cell infiltration is also noticeable.

The lumbar wound became infected and healed sluggishly, almost typically like a tuberculous wound and sinus. Healing finally was accomplished, and the patient was discharged apparently quite well February 9, 1921.

By far the most noticeable improvement aside from an absolute effacement of the bladder symptoms, was the very rapid subsidence of the torticollis. Physiotherapeutic measures, fruitless before nephrectomy immediately brought results after the operation. Practically no deformity was present at the time of his discharge. It was conceded that the kidney condition, even though infection was never demonstrated, must have been a causative

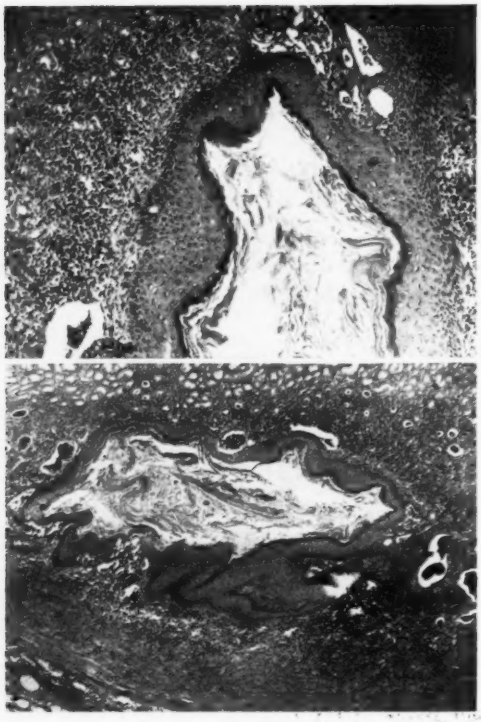

Fig. 3. A cross section of an edge of a calyx, very low magnification; enormous thickening of actual living epithelium at one point, and the same general picture as noted in Figure 2. The contiguous inflammatory changes are apparent. The higher magnification is made from a portion of the lower section. The figure illustrates the involvement as extending to the remote areas of the calyces.

agent in the production of the severe myalgic neck affection.

By way of discussion, three questions are presented, namely, whether stone, infection in general, or tuberculosis were etiological factors relative to the leucoplakia.

Certainly the symptoms, loss of weight, persistent frequency, burning micturition and hæmaturia, coupled with negative roentgen-ray and cultural findings, and the sluggish wound, strongly suggest tuberculosis. To disprove all these as evidence we have the diseased organ for intimate study and sufficient urinary data.

Other infection, connected possibly with early calculus formation, is almost a certainty in view of the torticollis; however organisms were at no time demonstrated and the stone removed from the bladder may have originated there. No history of renal colic was elicited, and had there been such it might more readily relate to the passage of epithelial clumps, an almost constant occurrence in other pelvis leucoplakias.

Certainly there was a stone removed from the bladder; a suprapubic scar was found and the patient treasured a large, smooth, white stone. In favor of the latter's origin in the diseased kidney is the widely accepted idea that chronic irritation gives rise to leucoplakia in mucous surface membranes. A rather striking symptom, relative to many of the cases reported, as brought out by Kretschmer, is the passage of the large epithelial plaques, described variously, but always giving rise to renal colic if coming from the kidney. Beselin's case had 200 attacks of colic; after a severe colic and the passage of the largest membrane noted, Beer's first case apparently recovered. We cannot believe in recovery unless the process involves only a very small area, and Beer's patient had attacks of colic for 3 years. No evidence of stone, tuberculosis, or other infection was found by Beer, similar circumstances to those in our own case. However, our patient had no renal colic, and while he admitted vague pain in the lumbar region in the past, none developed while he was in our hands; nor was there tenderness in the flank. Regarding infection, the gross kidney picture and the pathological report leave no doubt as to remote invasion of some organism.

The periods of onset and duration in reported cases vary a great deal; surely such distinct changes as we found did not develop after the first symptoms of bladder irritability. Years elapsed since the process of metaplasia began. Scrutiny of the photograph (Fig. 1) will plainly show how completely the normal lining was replaced.

Tissues deep to the mucous membrane may give evidence toward determining the age of the process. However, the epithelium in its deepest layer rested directly on a bed of granulation tissue in the specimen examined by Richey, while his patient had symptoms 22 years. In our specimen, no granulations

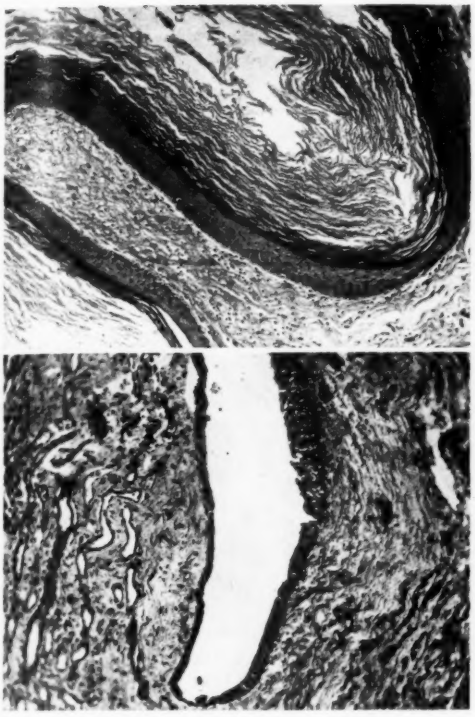

Fig. 4. Sections from a relatively normal renal pelvis and from that involved by leucoplakia; in the normal pelvis the epithelium is the usual transitional type, while in that involved by disease the epithelium is thicker and of the distinct squamous type, with a heavy layer of densely packed keratin, at least as thick as the epithelium itself. Beyond this, again there is noted the loosely packed keratin.

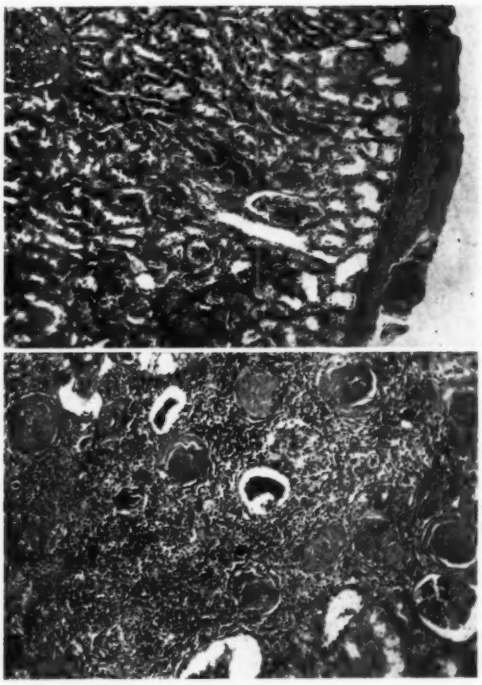

Fig. 5. Sections taken from the cortex of leucoplakia kidney; note thickening of capsule, inflammatory changes of glomeruli and their capsules, indicated by hyaline change and endothelial proliferation. The tubular epithelium also is swollen and granular.

appeared, the epithelium adjoining fibrous tissue.

Before taking up a brief general discussion of leucoplakia of the urinary tract, it will be of interest to note a few points in diagnosis regarding the fifteen reported cases involving the true renal pelvis. (Author's case included.)

Cases recognized at operation—8, as reported by Lecène, Braatz, Chiari, Beer, Hallé, Beselin, Richey, and Cumming.

Cases recognized without operation—2, as reported by Stockmann and Beer.

Cases recognized at autopsy—5, as reported by Hallé (2), Leber, Marchaud, and Rona.

Associated lesions—Tuberculosis—3 as reported by Beer, Beselin, and Hallé (ureter).

Stone—3, as reported by Chiari, Rona, and Hallé.

Pyonephrosis—3, as reported by Braatz, Lecène, and Hallé.

This summary indicates the difficulty of diagnosis in regard to leucoplakia; *a priori*, the condition in the bladder may always be recognized, while in the renal pelvis, only at operation or autopsy can one make certain of this pathology. The ureter, as Kretschmer states, also harbors leucoplakia with no pathognomonic symptoms, and has always heretofore been incriminated only by operation or autopsy.

For completeness, perhaps no other of the rare conditions found in the urinary tract is so well covered as leucoplakia. Englisch (3) and Kretschmer (1) have reviewed all the literature, the former's writings appearing in 1907, and the latter's in 1920. These authors

cite a number of the cases we have referred to in the foregoing tables. Other writers to whom we will refer are Wells (4), Morris (5), Braasch (6), Keyes (7), Adami (8), Beer (9), Haythorn (10), Ziegler (11), Osler (12), Albarran (13).

To understand the chemical processes involved in leucoplakia, we have Well's statement that it may be interpreted as a chemical alteration due to mechanical stimuli, with the formation of keratin by cells that ordinarily do not do so. Braasch, in speaking of the pathology in kidney pelves found to be dilated only at autopsy, refers to a proliferation and cornification of the mucosa with no evidence of obstruction or mechanical irritation. Keyes states however, that leucoplakia is usually due to stone or tuberculosis, and is the result of chronic irritation. Beer refers to Beselin's case of leucoplakia, in which cholesterin crystals were found attached to the plaques of exfoliated epithelium and mentions silicates as elements of the débris in his own case; here again distinct chemical changes demand explanation. Richey speaks of leucoplakia as a transformation induced by an alteration of environment wrought by a long-standing inflammatory process or a stone. Hallé mentions the high coincidence of leucoplakia and calculus but does not think mechanical irritation is the direct cause, leaning toward chronic inflammation as a better etiology. Albarran gave stone as the cause of leucoplakia.

Ziegler says of leucoplakia as given in the English translation of his text: "Epithelial metaplasia occurs most frequently in chronic inflamed mucous membranes. The change occurs in the following manner: after repeated loss of the original epithelium, the regenerating epithelium changes its character." He further states that this alteration occurs in transitional epithelium as well as in those places possessing pavement-epithelium. A small multitude of terms synonymous with "leucoplakia" has heretofore been confusing and still other terms are used erroneously. Metaplasia is perhaps a more correct expression of the process as Richey has pointed out. Other writers, notably Ziegler, Adami, Wells, and Keyes, apparently prefer "metaplasia." Richey warns against confusing metaplasia with heterotopia, heteroplasia, and anaplasia, and lucidly describes metaplasia as "the postnatal production of specialized tissues from cells which normally produce tissues of other orders." He further points out that the change embraces both a morphological and functional derangement in the cells; with a tendency toward the formation of a more highly from a less highly specialized type. Englisch and Kretschmer refer to the necessity of differentiating metaplasia (leucoplakia) from malakoplakia.

The unexplained dilatation of renal pelves with thickened cornified walls, represents in our opinion an early stage in the process of leucoplakia. Cornification, keratinization, epidermization, are terms to be applied to this early process and perhaps may be found much more often than it is generally recognized and recorded. We do not believe true leucoplakia exists often unrecognized, as such a profound change gives striking evidence at the table of either operating or autopsy room. While it gives rise to no characteristic symptoms other than the passage of epithelium in the urine (not a significant finding in our own case), symptoms of allied conditions have in all except a very few instances warranted operative interference.

One other factor relative to leucoplakia merits consideration here; namely, its relation to carcinoma. Osler, referring to this states that "the transformation of leucoplakia into carcinoma is indubitable. It is not a complication or an accident, but a distinct evolutionary development, the cause residing in the histogenesis of leucoplakia." Osler thus commits himself, but after a discussion of the process in tissues other than the renal pelvis.

Albarran was perhaps the first who ascribed leucoplakia of the renal pelvis as a cause or forerunner of carcinoma. Bauer stated that stratified epithelium in the kidney pelvis, due to metaplasia, is a common joint-finding with tumors. Schiewelbein believes carcinoma in his case of renal pelvis tumor, due to foregoing metaplasia. Taddei observes that leucoplakia likely gives rise to carcinoma in the renal pelvis and cites the case of Kischenski. Scheel states that the origin in his tumor case was

metaplasia of the transitional epithelium. Scaline concludes his case of epithelioma of the renal pelvis as due to leucoplakia and stone.

We are indebted to Kretschmer for this summary of the subject from the viewpoint of various men who have written on tumors of the renal pelvis. He refers to leucoplakia, stone, and infection as almost universally recognized forerunners of non-papillary carcinoma.

Ziegler states that epithelial tumors arising from transitional epithelium may bear the character of squamous-celled tumors. Morris, writing on the same topic, says that in transitional-celled and squamous-celled carcinoma of the renal pelvis, transformation of the lining epithelium to leucoplakia is sometimes the starting point of the squamous-celled tumor.

Finally, one is struck by a real controversy as to the origin and essence of leucoplakia. Adami discusses the opposing views of many pathologists. He himself considers metaplasia predicated by the certainty that epithelial change must simply result in another form of epithelium, and thinks the process may explain certain "cell rests." Richey quotes Orth and Schridde as saying that metaplasial conversion occurs through the mediation of cells not completely differentiated so that formative cells may abandon their attributes and revert to cells having all the powers of differentiation of the embryonic cells from which epithelium develops. The only necessity is epithelial tissue, not some other, as the end-result.

CONCLUSIONS

1. Leucoplakia of the renal pelvis is a rare condition; the bladder is more frequently involved and in the bladder one can readily recognize leucoplakia by cystoscopy.

2. The histopathological picture is that of a replacement of the normal transitional epithelium by a many-layered coating of stratified squamous epithelium showing on the surface varying degrees of keratinization. In the case herewith presented, the pelvis was stuffed with dry keratin flakes.

3. Etiological possibilities are vague and must be based on histogenetic laws and clinical coincident disease. Stone, infection, or carcinoma, occur with leucoplakia in many but not all cases.

4. While syphilis and alcoholism have a definite relation to leucoplakia elsewhere, neither seems to bear upon the affection in the renal pelvis. Inflammation of the renal or urinary mucosa probably accompanies all metaplasia but cannot definitely be ascribed as producing it.

5. The symptoms are those of related conditions, except for the painless passage of epithelial membrane. Symptoms of stone, tuberculosis, and tumor are most mentioned.

6. Operative treatment of advanced cases is certainly advisable, nephrectomy being most often indicated.

7. More diligent study of specimens obtained at operation and autopsy may bring to light a greater number of instances of leucoplakia, although this seems doubtful in view of the definite picture presented by operated cases.

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ECHINOCOCCUS DISEASE OF THE KIDNEY[1]

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ECHINOCOCCUS disease of the kidney may be of two types: (1) The primary type in which the kidney, as far as can be demonstrated clinically, is the only organ involved. This type of echinococcus infection is very rare. The case to be reported in this paper belonged to this type, as far as it was possible to determine at the operation. (2) It may be part and parcel of a general infection in which this condition is found in other organs, such as the liver, spleen, intestinal tract, peritoneum, etc.

It is generally believed that renal hydatid is one of the rare kidney lesions even in countries where echinococcus disease is of common occurrence. In this country where this condition is uncommon, there is a correspondingly small literature dealing with this subject. Lyon, in 1902, was able to collect a series of only 241 cases of echinococcus disease that were reported in the United States and Canada. Naturally the literature of renal hydatid would likewise be a small one. In the literature at my command I have been able to find 17 cases reported, in which there was kidney involvement by echinococcus. This with the case to be reported below brings the total number of kidney cases reported in Canada and the United States up to 18.

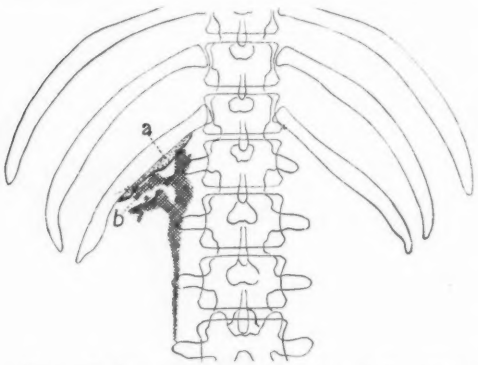

Fig. 1. Pyelogram showing depression of the calyces by the area of calcification.

THE STATISTICS DEALING WITH THE OCCURRENCE OF KIDNEY ECHINOCOCCUS

The statistics dealing with the frequency with which the kidney is involved in a general echinococcus infection are somewhat at variance, between .02 to 5.4 per cent. Regarding the frequency with which the kidney is involved in echinococcus disease, Garceau stated: "The kidney is affected in about 1 per cent of the cases, according to Finsen, who examined 255 cases of the disease, and found only three, or 1.17 per cent, in which the kidney was affected. It is interesting to observe that in these 255 cases the disease began in some organ in the abdominal cavity in 92 per cent of the cases. Thomas collected reports of 307 cases occurring in Australia between the years 1868 and 1877. Among these there were only 2 cases, or .065 per cent, in which the kidney was affected. Morris collecting the figures of various observers got together 2,111 cases and among these the kidney was affected 115 times, or 5.44 per cent. Gardner, who had a large personal experience in treating hydatid disease, is inclined to believe that the number of kidney cases must be very small. He makes the comment that the large percentage given by the other observers must be due to the fact that their lists were compiled, not from personal experience but from published reports of others. These results must be misleading, for, owing to the comparative frequency of echinococcus of the liver and lungs, many cases must have passed unpublished, whereas it is probable that the renal cases on account of their rarity have been more commonly reported.

Gardner's opinion is confirmed by the figures of Cromwell and Vegas, who in a list of 1696 cases of hydatid disease occurring in Buenos Ayres, found the kidney affected only 36 times, or .021 per cent.

G. Y., male, Greek, age 32, referred by Dr. George Parker, Peoria, Illinois. In 1917, according

[1] Read at meeting of Chicago Pathological Society, March 13, 1922.

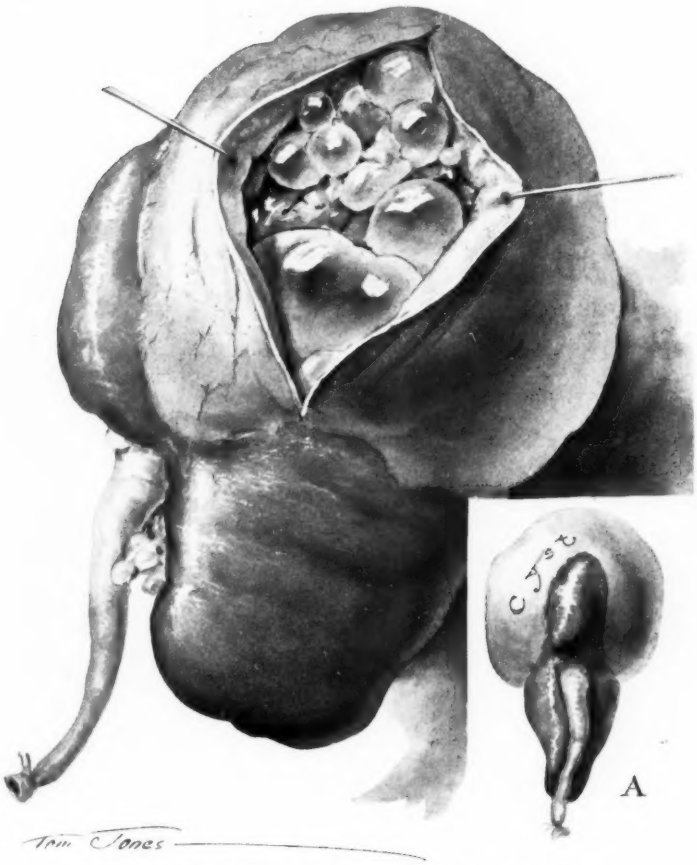

Fig. 2. Showing echinococcus cyst occupying upper half of kidney.

to the patient's statement, he had an ulcer of the stomach, and influenza in 1918. Venereal disease denied. Patient was cystoscoped three times in May, 1921, and tumor of the right kidney was diagnosed.

Present complaint. When patient entered the Presbyterian Hospital, he complained of pain over the right kidney region, frequency of urination, painful urination, hæmaturia and loss of weight.

Symptoms began one year ago with an attack of hæmaturia which lasted 2 weeks. At that time he had an attack of severe pain over the right kidney region, lasting 2 hours, which radiated to the groin and back. Morphine was required for relief. Two days after the attack a "small round body about the size of a pea was passed" which the patient described as soft, with tiny particles of gravel in it. When allowed to dry it was crumbly and the particles had the appearance of gravel. Nothing was passed in the urine since that time. About 2 weeks after the first attack of hæmaturia he had a second attack which occurred without colic. This lasted about a week. No hæmaturia noticed since that time.

Pain over the right kidney began with hæmaturia. He has had ten or twelve attacks during the last year, lasting for a few days each time. Pain is described as a dull ache along the twelfth rib, extending around in front to the level of posterior axillary line. Frequency of urination is slight, but has been present at times. He has lost about 2 pounds in 2 months.

Examination of abdomen showed no tenderness, rigidity, or tumor masses. The kidneys were not palpable and not tender to fist percussion. Cystoscopy showed the bladder negative. The ureters were catheterized without difficulty or obstruction. Phenolsulphonepthalein test was made, and the

Fig. 3. Bisection of kidney.

dye appeared in 6.5 minutes on the right side and 6 minutes on the left side. Cell count and cultures showed the following:

	Cells	Cultures
Bladder	30	Sterile
Right Kidney	50	Sterile
Left Kidney	30	Sterile

Roentgen-ray examination. At a point near the upper pole of the right kidney there is a shadow which is apparently the lower margin of a mass the envelope of which is calcareous in nature. This curved calcareous line when followed outward and upward is incomplete, so that only part of the envelope is calcareous. The presence of this area of calcification was demonstrated in the specimen removed at operation.

Pyelogram (Fig. 1): The upper calyx is deflected inward and the middle calyx deflected downward at a point where the calcareous mass impinges upon the pelvis.

Operation, June 28, 1921. The right kidney was exposed by the usual oblique lumbar incision. The perirenal fat was dissected away, exposing a large, firm, globular mass about 20 centimeters in diameter, occupying the upper half of the kidney and bound by firm fibrous adhesions to the surrounding structures. The kidney pedicle was clamped, doubly ligated, and clamps removed. The ureter was secured and ligated about 10 centimeters distal to the pelvis, and the kidney removed. During the operation a very large hole was torn in the peritoneum, because of the difficulty in delivering the tumor and because of the presence of adhesions. This large opening gave an excellent opportunity to examine other organs before closing the wound. The liver was very carefully gone over for the presence of echinococcus cysts, but apparently it was normal. Exploration of the rest of the abdomen was negative.

The patient had a rather stormy convalescence for about 10 days and complained of a great deal of abdominal pain, nausea and vomiting. At one time 300 cubic centimeters of fluid were obtained from his stomach and a provisional diagnosis of acute gastric dilatation was made. After his gastric symptoms had subsided, patient made an uneventful recovery.

Gross description. The kidney measured 13 centimeters in length, 7 centimeters in width and 5.5 centimeters in thickness. In the upper, outer half was a tumor 11 centimeters long by 11.5 centimeters in width and 8.5 centimeters in thickness. The tumor projected from the upper half of the outer convex border and extended obliquely downward toward the lower pole so that the lower border was 7 centimeters above the latter point (Fig. 2). Exteriorly, the mass was firm and smooth except for very slight roughening, caused apparently by bundles of fibrous tissue, and the color was pink to yellow white. When opened, the tumor proved to be a sac with a firm, fibrous wall about 1 millimeter thick, smooth, and yellow inside, and from which a cheesy yellow material could be scraped in small quantities. The inside of this tumor was filled with many small cysts, varying in size from a few millimeters in diameter to 10 by 6 by 2 centimeters (Fig. 3). Some of them were filled with clear fluid; others were empty and several layers thick, the walls composed of a gelatin-like material, rolled up like a scroll in some instances. Quite a number were free in the sac and were filled with a clear, colorless fluid which could be seen through the wall of the cysts which was almost transparent.

A pre-operative diagnosis of tumor in the right kidney was made, this diagnosis being based upon the following facts:

1. The presence of pain in the right kidney region.
2. Hæmaturia, which had been first noticed about a year ago.
3. Slight loss of weight.
4. The pyelogram.
5. The presence of small areas of calcification interpreted as being due to calcification in a tumor.
6. Absence of signs of infection in the urinary tract demonstrated bacteriologically.

The diagnosis of tumor was correct so far as it went, but the nature of the tumor was not recognized. In spite of the patient's

age (32) a tentative diagnosis of malignancy was made, based partly upon the fact that malignant tumors of the kidney are the most frequent renal tumors and, furthermore, because the calcifications seen in the roentgenogram were interpreted as being calcifications in a malignant tumor. This decision was based upon a previous experience in which somewhat similar calcifications were seen in a case of malignant papillary cystadenoma of the kidney.[1]

One fact in the history deserves mention and that is that the patient stated that he passed a small round body the size of a pea, which he described as being soft in consistency and that it had particles of gravel in it. Later he again passed some shreds in his urine, which he brought to Dr. Parker and which Dr. Parker sectioned. This proved to be a mass of necrotic tissue, and it had nothing suggestive microscopically upon which a diagnosis of echinococcus could be based.

A pre-operative diagnosis of echinococcus of the kidney is not made very often. In the case which Osler had, the diagnosis was echinococcus, possibly in the right kidney, diagnosis being based upon repeated attacks of right-sided renal colic associated with the passage of daughter and granddaughter cysts in the urine. Schmidt, in his report of a case, says he saw his patient twice, an interval of about a year elapsing between the times. When first seen an operation was advised, because he "had strongly suspected a new-growth." "Upon the patient's return a year later he brought with him a specimen of urine which contained 25 or 30 clear oval and round-shaped pearls of varying size and from this evidence there was no question as to the character of the trouble." Russell and Kilbane failed to make the correct diagnosis before operation. "Upon questioning the patient after operation he stated he had passed grape-like cysts in his urine and had this been known a correct diagnosis should have been made."

Mercier diagnosed a lipoma in his case, cyst not being suspected owing to the long period of development.

[1] Kretschmer and Moody. Malignant papillary cystadenoma of kidney with metastases.

Leighton and Lewis made a pre-operative diagnosis of tumor, the nature of which was uncertain.

Haynes, in his case, made a diagnosis of pneumonia of the lower lobe of the right lung and acute appendicitis; patient was operated upon. While liberating the appendix a hard mass was felt in the upper part of the field. It was thought to be a kidney containing a large calculus. In freeing the kidney a soft spot in its anterior surface was ruptured and some fluid and several small, whitish spherical bodies floated upward and escaped through the wound.

A pre-operative diagnosis of hydatids of the left kidney was made by Fauntleroy, who based his diagnosis upon pain in the left lumbar region and the passage of small cysts in the urine.

In Allaben's case the patient gave a history of previous operation for echinococcus of the mesentary and omentum.

The diagnosis can be made in cases in which the history brings out the fact that the patients have passed cysts in the urine, or, better still, if the patient brings the cysts in with him.

Before the cyst communicates with the pelvis of the kidney, diagnosis is very difficult; after the cyst has reached a certain size, the diagnosis is that of some sort of tumor of the kidney. The diagnosis should be relatively simple after the cyst communicates with the kidney pelvis so that small cysts are passed with the urine. In several instances a diagnosis of echinococcus disease was made on finding cysts in the urine. Without this evidence, a differential diagnosis must include the various lesions of the kidney as well as various other intra abdominal lesions.

NATIONALITY

In 6 of the 18 cases the nationality was not stated. In the remaining 12 cases the nationalities were:

Italians	5
Greeks	3
German	1
Swede	1
Russian Pole	1
English	1

It is evident that echinococcus of the kidney is rare among the native born.

SEX

There was a great preponderance of males over females: 15 males and 3 females.

AGE

The following were the ages:

	Cases
20 years	1
21 years	1
23 years	1
32 years	2
34 years	1
35 years	1
38 years	1
43 years	1
45 years	1
46 years	1
49 years	1
52 years	1
53 years	2
55 years	1
58 years	1
Age (not stated)	1

SUBJUNCTIVE SYMPTOMS

Early in the course of the disease there may be no symptoms in case the tumor is small or before the cyst has ruptured into the renal pelvis. After the cyst has enlarged, it may be felt by careful palpation.

The presence of a tumor was recorded by Downes, Keyes and Busch, Leighton and Lewis, Mercier, Stavely, Marsh and Young.

In some of the case reports the definite statement is made that a tumor mass was neither felt nor demonstrated: by Fauntleroy, Russell and Kilbane, Osler, Schmidt, and by Young in his 2 cases. In my case abdominal palpation was negative.

Although in the majority of cases, no tumor was palpable, local findings on one side or the other were demonstrable upon physical examination: right kidney enlarged and tender (Guiteras), tenderness over the right iliac fossa with rigidity of the abdominal muscles (Haynes), flatness in the axillary line extending to the crest of the ilium (Keyes and Busch), tenderness in the region of the spleen and increased area of liver dullness (Kinyon), a slight tenderness over the right kidney (Russell and Kilbane), and tenderness and muscle spasm in the epigastrium (Young).

PAIN

When a patient consults the physician, he does so on account of pain and this symptom is the one most frequently present. The pain may be due to the cyst and is often referred to the region of the kidney, not infrequently being of a colic-like variety, due, no doubt, to the passage of small or large daughter or granddaughter cysts. In some instances in the case reports mentioned the renal colic was due undoubtedly to the passage of clots, inasmuch as the renal colic was present during the time of active bleeding. As stated above, the pain was most frequently referred to the lumbar region, or over the tumor. Pain in the groin was noted by Guiteras; in the epigastrium by Young; in the abdomen by Haynes; in the region of the liver by Keyes and Busch; and in the kidney and bladder by Kinyon. In only one case (Schmidt) pain was referred to the glans penis.

Painful micturition was noted by Allaben, Fauntleroy and Kinyon, and burning on urination was present in one of Young's cases.

Hæmaturia was mentioned in 5 cases: Young, Guiteras, Marsh and Kinyon, and in the case reported in this paper.

The passage of cysts in the urine were noted in the cases of Fauntleroy, Young, Russell and Kilbane, Schmidt and Osler. In the case reported here the patient gave a very definite history of the passage of what in the light of subsequent events undoubtedly were cysts.

EOSINOPHILIA

Echinococcus disease is one of the conditions which is supposed to produce an eosinophilia in the blood. This was characteristic in the case reported in this paper since prior to operation an eosinophilia of 8 per cent was found. A recent examination of the blood by Dr. George Parker showed an eosinophilia of 7 per cent.

In this connection the statement by Downs that in his case there was no eosinophilia, is interesting.

ECHINOCOCCUS FIXATION TEST

Young's case reports are the only ones which indicate that this test was made, and he states that the test was positive in one

case 4 weeks after operation. In his second case the test was positive before operation and negative 26 days later; in his third case it was positive 35 days later. In my case, tests made 10 months after operation were negative with human cyst fluid and positive with pig cyst fluid.

It would appear that this test would be of great value in cases in which echinococcus infection is suspected before operation. According to Gallart-Monés, the reaction is of absolute value when it is positive because the test is specific.

Whether or not the intradermal reaction will be of value as an aid in the pre-operative diagnosis, remains to be seen.

PYELOGRAMS

Records of pyelograms made prior to operation were found in but one case, namely, in Young's, who states that an abnormal pelvis was present. In my case the pyelogram appeared as if it were being impinged upon by a mass from above (Fig. 1).

Braasch, in his monograph on pyelography, does not mention pyelography findings in this rare disease. Whether or not a pyelogram typical of this disease can be obtained, so as to aid in diagnosis, must remain for the future to determine. As this disease is not common it will probably be some time before a classical pyelogram, or what constitutes a typical pyelogram is established.

TREATMENT

Various forms of surgical treatment have been advised and practiced from time to time, but some of them are considered obsolete today.

1. *Delbet's operation.* This operation was first suggested by Delbet and performed for hydatids of the liver. However, this operation cannot be performed in most cases of renal hydatids, although cases successfully operated upon by this method have been reported by Lejars and Billot.

2. *Nephrostomy.* This operation is rarely if ever used at the present time and was resorted to in the early period of kidney surgery. There may be certain instances in which, because of the extreme weakened condition of the patient, the extensive size of the cyst and the presence of adhesions, this method may be employed as the only way out or preliminary to a later nephrectomy. As a general proposition, however, it may be stated that this procedure is obsolete.

3. *Resection.* Undoubtedly this is the method of choice in cases in which it is possible to carry it out. However, in the largest number of instances it is not possible to do this. Where small cysts are present, or in cases in which the cyst may be pedunculated, this is easily the method of choice, especially if the cyst is located in one of the upper poles or if the tumor springs from the convex border. In instances in which the tumor takes origin from the hilus or where the tumor is adherent to the vessels, this method would not be as desirable as nephrectomy.

4. *Nephrectomy.* This seems to be the method of choice with the surgeons of this country and technically should offer no more serious difficulty than any other type of nephrectomy. Of the 18 cases reported in this paper, nephrectomy was carried out nine times. Fauntleroy treated his case with carbolic acid and Mercier practiced removal of the cyst. One of the 9 cases operated died, this being the case reported by Leighton and Lewis. Complete recoveries were reported in the remaining cases.

J. E. Allaben's Case

Female, age 52, German. Had been ill in Germany more or less for 17 years. Laparotomy was performed in Greifswald Hospital, in 1879, for echinococcus cysts of the mesentery and omentum. Shortly after, a number of cysts were passed from the bowels. Since the operation the patient has performed the duties of a housewife but has felt that her ailment was not entirely relieved. When first seen she was confined to bed, weak and emaciated; she suffered retention of urine, was constipated, and the abdomen was moderately distended but not tender on pressure. Tonic treatment was instituted, which was followed by good health for a short time. Then she began to complain of pain in the right arm and leg. Her mind also seemed to be affected. Sensation in right arm and leg diminished and grasp of the right hand was weak. In a week these paralytic symptoms had greatly increased and in 2 weeks there was complete paralysis of the right side. She gradually declined and died at the end of 6 weeks.

Autopsy. The intestines and stomach adhered to each other in one inseparable mass. Six hydatid

tumors, from the size of a hen's egg to that of a goose egg, were attached to the bladder at various points; one hard tumor the size of a hen's egg was in the right side of the pelvis. There was a large one in the capsule of the liver on its upper surface adherent to the parietal peritoneum. The spleen was contracted and enclosed in a mass of tumors of various sizes and bound to them by inflammatory formations. The kidneys had several small cysts on their outer surfaces. The parenchyma of the kidneys and liver was normal. A mass of tumors was located on the omentum under the umbilicus. Another mass of tumors, which originated in the omentum and which was adherent to the liver, was under the ensiform cartilage. Tumors were also found at various points on the peritoneum lining the abdominal walls.

W. A. Downes' Case

Male, age 49. For 15 years patient had complained of pain and of a mass in the left side, but barring one or two attacks of some discomfort he had had no serious trouble until 2 years ago when the attacks became more frequent and the large mass interfered with his going out and attending to his business. Examination showed a smooth non-fluctuating mass filling the entire left side of abdomen. The ureters were catheterized and showed a rapid flow of urine from the left side; the right side showed a normal flow. The urea on left side was much diminished. Blood examination showed no *eosinophilia*.

Operation. The kidney was found to be the seat of a thick-walled cyst, very adherent and separated from the descending colon with difficulty. Convalescence was slow but entirely satisfactory.

A. M. Fauntleroy's Case

Male, age 45, had suffered for years at irregular intervals with pain in left lumbar region, radiating to the hip, thigh (of same side), and bladder. He had marked abdominal tenderness, and frequent painful and often prolonged efforts at micturition with discharge of turbid urine. The discharge was usually preceded or accompanied by the escape of small cysts containing translucent fluid. At times the little bladders were discharged already broken and devoid of contents. A diagnosis of hydatids of the left kidney was made.

Upon examination no enlargement or tumor was found in the region of the kidney. From this fact and from the apparent readiness with which the patient's hydatid cyst ruptured into the *renal pelvis*, the inference was that the pyramidal structure of the kidney alone was implicated. The ready escape of the so-called daughter vesicles *per urethram*, together with the above circumstances, offered grounds for a favorable prognosis. Patient was treated with mild laxatives, warm applications to abdomen, an anodyne for the paroxysmal pains and carbolic acid internally to destroy the hydatid cyst.

Guiteras' Case

Female, age 20. Three years ago patient had an attack of severe pain in right lumbar region and groin, lasting for 3 days, during which time there was hæmaturia. One month ago she had an attack of acute pain in the same locality. The urine was bloody and voided with difficulty. The severity of the pain gradually diminished, but more or less pain on that side remained. On the first visit her temperature was 98.4° to 100° F.

Examination. The right kidney was enlarged and tender, extending over to the median line. Cystoscopy showed the bladder to be normal. The ureters were catheterized. Urine from left side was secreted normally and found normal upon examination. The urine from the right side flowed more slowly; was very pale and contained a trace of albumin, a few blood and pus cells, a few hyaline casts, renal epithelia, uric acid and triple-phosphate crystals. No exact conclusion was arrived at regarding the case and an exploratory incision was made. The kidney was found to be much enlarged; the upper pole enlarged and adherent to the diaphragm. The lower pole was smaller and twisted. A cyst, with a thick white sac, 3½ inches in length and 2½ inches in width was seen springing from the anterior surface of the kidney and pelvis. This was opened and a considerable amount of amber fluid and a number of small white daughter cysts escaped. The outer surface of sac was dissected away, and the remainder treated with carbolic acid and alcohol. During the first week after operation, the temperature ranged from 100° to 104° F. Pulse was 136 due to ether pneumonia; then became normal, and the patient left the hospital with the wound healed.

I. S. Haynes' Case

Male, age 32, Italian, admitted to hospital December 26, 1901, for operation on double inguinal hernia.

Examination. Tenderness was present over the right iliac fossa with some rigidity of the overlying abdominal muscles. An ice bag was applied to the region and calomel given in divided doses. At 9 P.M., same day, temperature was 99.4° F., respiration 26, pulse 84. The next morning the pulse and respiration were the same and temperature was 102°. Epsom salt had been given early in the morning followed by several bowel movements. Examination of lungs showed dullness, prolonged, high-pitched respiration, a few râles, absence of tactile fremitus at the base of the right lung behind. His abdominal symptoms were more severe, muscular rigidity spreading to include the right rectus, and there was increased tenderness over the appendix.

Diagnosis. Pneumonia of the lower lobe of right lung and acute appendicitis. On December 30, the evidences of acute appendicitis having rapidly increased in severity, operation was decided upon despite pneumonia, as his chances seemed better without the appendix than with it. The condition

about the cæcum was noteworthy. Adhesions of long standing covered the cæcum and ascending colon and united them firmly with the abdominal wall, the small intestines and the omentum.. After considerable difficulty the appendix was found lying posterior to the cæcum and extending upward; removed. While liberating the appendix, a hard mass was felt in the upper part of the field. The wound was enlarged upward. The mass lay deeply in the loin beneath the intestines welded together by old adhesions. It was exposed and because of its hardness and position was thought to be a kidney containing a very large calculus. In freeing the kidney a soft spot on its anterior surface was torn through and some fluid and several small whitish spherical bodies floated upward and escaped through the wound. The atrophic remains of the vessels and ureter were tied off, although there was little need for the ligature, as on examining the specimen no previous vessels or ureter could be seen. The wound was flushed and closed over a wick and tube drainage because of the probable infection through escape of the cysts and fluid. The wound healed rapidly to the drain. The pneumonia increased in severity and patient died 8 days after operation. Autopsy was not permitted. During the operation the liver was palpated and found not enlarged or nodular but unusually hard.

The cyst measured 6 by 4½ centimeters. The shape was distinctly that of a contracted kidney, one-half of which was slightly larger than the other. The wall varied from 1 to 2 centimeters in thickness and was fibrous without, lamellated toward the center, and covered within by a finely granular parenchymatous layer. In places the lamellated portion was calcified. The cavity was composed of one large and two smaller communicating loculi, which contained a score of translucent parasitic cysts of various sizes. In these cysts there were hooklets and cholesterin crystals but no scolices; the walls were of the usual lamellated character. Microscopic examination showed no traces of renal tissue, the outer wall being composed of dense fibrillar connective tissue infiltrated with lymphocytes.

William C. Keyes and Frederick C. Busch's Case

Male, age 53, had pain in the right side, in the region of the liver; coughed up greenish fluid of a disagreeable odor and of an acrid taste. The right chest was bulging; the right pleural cavity was aspirated; could be felt just below the ensiform cartilage and to the right; also explored with the hypodermic needle with no result. Upon percussion the liver flatness did not extend downward below the free border of the ribs, but extended as high as the nipple in front and, at the same level, to the median line behind. In the axillary line, flatness extended to the crest of the ilium. Inguinal hernia on the left side.

Patient died; autopsy was performed.

Left kidney was large and pale. The right kidney was covered anteriorly by a large cyst; anterior and upper half atrophied to half its normal size; the posterior half flattened from the pressure of the cyst.

The cyst measured 18 centimeters in its long diameter and 14 centimeters in its short diameter, pressing upon the right kidney below and extending to the diaphragm above. It contained a large number of daughter cysts, many of them filled with a clear, limpid fluid, and of great beauty. Others were collapsed. In these, scolices with hooklets were demonstrated. Since the capsule of the kidney was continuous over the cyst, the latter probably arose in the cortex, leaving a cup-shaped excavation in it, which was occupied by one end of the cyst.

The urinary bladder contained about 47 cubic centimeters of amber-colored urine. Examination of the latter revealed nothing of importance.

J. J. Kinyon's Case

Male, age 38, Swede; admitted to U. S. Marine Hospital, New York, March 8, 1890; died August 19, 1890. Patient was in hospital from June 14, 1889, to June 29, 1889. Diagnosis: chronic Bright's disease. He complained of a steady and severe pain in the back and in the region of the kidneys. He had to pass urine every hour in small quantities; urine contained considerable blood. He was unable to keep anything on his stomach and vomited immediately after eating. Tenderness was present in the region of the spleen and there was an increased area of liver dullness. The urine was examined and found to contain large quantities of albumin. Patient was discharged June 29, 1890, much improved. About 3 years before this time he was seized with severe pains; passed a very large quantity of blood with his urine; pain especially severe on urination. This attack lasted about a week. He experienced no further trouble until he had similar symptoms about a week before admission to the hospital, June, 1889. After his discharge from the hospital he felt somewhat better for several months. About 3 months before admission to hospital, March, 1890, he began to grow worse again; return of same symptoms, at intervals, which increased in frequency until he came to hospital, at which time he had lost considerable weight and was very weak. When admitted he had no appetite, and suffered from nausea and vomiting, accompanied by severe pain in the stomach, and was constipated. He had an organic urethral stricture of long standing and was admitted to the hospital under that diagnosis.

Examination showed a very small meatus and a stricture in the membranous portion of the urethra. The urine showed a large quantity of albumin. A few days later he complained of severe pains in the region of the bladder and was cystoscoped. On the posterior wall of the bladder, near the ureteral orifice, was seen what appeared to be a tumor—round and of a dark red color. The blood vessels were seen and what appeared to be villi on the surface of the mucous membrane. The patient was dis-

charged "improved" on March 28 and readmitted for chronic Bright's disease.

After his readmission he gradually improved, and the vomiting after meals stopped; the pains in the region of the kidneys and bladder ceased, except occasionally and then only for a day at a time. His urine was examined from time to time and was found as a rule free from albumin. The bladder was cystoscoped several times and the results were similar to the first time. The urine was free from blood but during the night of June 3, it suddenly became dark colored, due to a large quantity of blood. Blood was found in the urine for 2 or 3 weeks, then the urine became clear again, but on July 22 it again contained blood. The average amount of urine passed was 2,500 cubic centimeters per diem. The examination showed considerable albumin, probably due to the presence of the blood. He suffered loss of weight and strength. He continued to pass blood in the urine until July 26; chloroform was administered and a suprapubic cystotomy was done in order to explore the bladder. A thorough examination of the bladder walls revealed several blood clots but no tumor. Prostate gland examined before the operation, was found to be only very slightly enlarged, very hard and firm. After the operation, a very severe vomiting spell occurred; then no nausea for several days, followed by nausea and vomiting which continued until his death.

Soon after the operation patient complained of severe pain over the left kidney, which lasted for a few days and then disappeared. He became much emaciated and very weak. During the period of severe pain (night of August 4) temperature suddenly ran up to 40° C., and the pain was much increased. During the succeeding week it dropped to 36° C. on the night of August 14, and remained at 37°C. or a little above until death. Urine, examined again on August 14, contained a large quantity of albumin. For 48 hours preceding death patient could be aroused only with difficulty sufficiently to understand when he was spoken to.

Rigor mortis was well marked. Thorax opened; pericardium normal. Heart in systole, small; walls indicated eccentric hypertrophy; valves normal. Slight (old) interlobular pleurisy in both lungs; otherwise normal. Right kidney about two or three times normal size and adherent to surrounding tissues. Kidney's surface and substance one mass of cysts; a large abscess near the center of the kidney. Hæmorrhages were found in some of the cysts; the latter the result of echinococci formations, as was revealed by microscopic examinations. Capsule nonadherent. Left kidney was somewhat larger than right; with the exception of a large abscess in the right, the condition was the same. Kidney was firmly adherent to the spleen and surrounding tissues. The liver was about twice the normal size, fatty and cirrhotic, its surface covered with numerous cicatrices and cysts. The latter throughout the liver substance had the same appearance and same formation as those of the kidney. The spleen was much enlarged, firm and apparently normal. The intestines were apparently normal. The bladder had a ridge or elevation across the posterior and dependent portion which contained cysts of echinococcus formation as in the kidneys and liver. The mucous membrane of the bladder was thickened and inflamed. The brain and spinal cord were not examined.

W. E. Leighton and B. Lewis's Case

Female, age 35, Italian, entered hospital because of a tumor in right lumbar region; suffered great pain and distress. The tumor had been present for about 4 years; had gradually increased in size until patient was no longer able to work because of its size, feeling of weight, and pain.

Examination revealed a tumor in right lumbar region, which bulged outward and forward. Percussion showed it to extend from the border of the ribs to the iliac fossa. It was smooth, rounded, and solid to the touch, except at a point near the umbilicus where it felt soft or cystic. Though it was continuous with the liver dullness, it was movable. It occupied the space of the right kidney. The left kidney was not enlarged.

Urinalysis: specific gravity, 1,020; acid; trace of albumin; no sugar. The sediment showed a few granular casts, round and squamous epithelium and many leucocytes.

Tumor of the right kidney was diagnosed, the nature of which was uncertain.

Cystoscopic examination showed normal bladder. The left ureter was easily catheterized and clear urine collected. The right ureter could be catheterized only for about 1 inch, from which oozed a turbid fluid. The specimen from the right ureter showed only pus cells with no kidney elements, while that from the left kidney corresponded with the previous examination and showed chronic nephritis of the left kidney.

Exploratory operation. The right kidney was exposed by an oblique lumbar incision; a white, hard tumor similar to a thick-walled ovarian cyst instead of its usual appearance. In an effort to free the cyst from where it was adherent to the ascending colon, the tumor ruptured and a small amount of fluid with many egg-like cysts escaped; there was then left only a thin-walled sac, which represented the remnant of the kidney.

Patient died 5 days after operation. No autopsy; but the lungs, heart, spleen, and left kidney were removed through the operative wound. No other cysts were found. The heart was dilated and showed an insufficient valve. The left kidney was enlarged and showed chronic changes.

J. O. Marsh's Case

Male, age 53. Patient had not felt well for several days when on April 1, 1866, after lifting a box of fruit, a sharp pain occurred in the left lumbar region which passed off in a few hours. During the follow-

ing 2 days patient voided bloody urine. There was more or less pain in the region of the left kidney from this time on; he passed a little blood in the urine once or twice, but there was no special urinary trouble.

General health declined. During the first year a tumor was perceived in the left lumbar region which increased downward and forward. Occasionally lancinating pain radiated from the spine, through the tumor, and down to the left testicle, which at one time was swollen and tender. No sexual desire.

The tumor occupied the whole left side of the abdominal cavity and extended 2 inches to the right of median line. The ribs and abdomen protruded on the left side. The tumor was smooth with obscure fluctuation. Percussion was dull as high as the fifth rib. Slight tenderness was present in median line and left lumbar region. The urine was scanty and for 3 or 4 days before death none was voided. Patient died June 15, 1869.

Autopsy. Extreme emaciation. The intestines were adherent to the tumor and to each other. The tumor measured 29¾ inches, long circumference, 13 inches transverse; weight was 10 pounds. Examination showed it to be a hydatid cyst.

O. F. Mercier's Case

Male, age 55. About 17 years ago patient first noticed an indolent tumor in the right renal region, gradually increasing in size until it attained the volume of a child's head. Little inconvenience was experienced until 2 years ago, when pains occurred which became almost unbearable during the past weeks.

The tumor was situated about 15 inches to the side of the crest of the ilium, measuring 7 inches in its long axis and 4 inches transversely. Palpation caused intense pain. The tumor appeared to be rather resistant but was not soft; no fluctuation, hardness or nodules. It could not be separated from the overlying tense skin; therefore it was thought to be a lipoma. Cyst was not suspected owing to the long development.

Operation. A right lumbar incision was made and an incapsulated growth found. The capsule was incised and an attempt made to decorticate same, but because of many adhesions, both superficial and deep, the cyst was removed entire. A considerable amount of fluid escaped. There were many smaller cysts the size of a small hen's egg, all more or less adherent to each other. In detaching these, two or three ruptured, with escape of considerable thick, grayish pus and numerous small daughter vesicles. Further search was made until all of these were found and removed, about 20 in all, after which the mother vesicle was enucleated. Recovery was complete in 3 weeks; after 5 months, no recurrence.

H. Minet's Case

Minet reported the findings in a specimen of a calcareous kidney associated with hydatid cyst, the clinical history and macroscopic appearance of which he had presented to the Urologic Society in March, 1919. At that time no definite diagnosis was made. Gregoire and Chevasse examined the specimen and found that an intrarenal cyst had developed at the lower pole within the capsule, compressing the adjacent cortical substance, these forming a slight sclerosis invested by the capsule proper. The internal membrane was continuous with its leaflets, giving to the calices a characteristic striated and zigzag appearance. The calcareous deposits were situated between these leaflets, more abundant at the dependent portions than in the neighboring renal tissue; the membrane proper was partially transformed into a calcareous shell. The uneven partitions of these calcifications gave the roentgenograph picture of a vacuolated and irregularly stratified appearance quite different from the picture of the renal calculus of the pelvis, which was found in the same kidney and which increased the interest in this exceptionally race case.

William Osler's Case

Male, age 58, Englishman. Farmer; formerly a butcher for 15 years. Patient enjoyed good health until about 4 years ago when he had a severe attack of nephritic colic on right side lasting only a short time and quickly relieved. He had no further trouble until 2 years afterward when he had a similar attack, confining him to bed for several weeks. Some days he was better but always worse on exertion. After a period of improvement for several weeks, during which time he was able to attend to his farm duties, he felt a pain and uneasiness over right kidney, followed in a day or two by pain at the point of the penis, which continued several hours and was relieved by the passage of gelatinous masses in the urine. These bodies, hydatid, he has continued to pass at intervals of from 2 to 4 weeks. The discharge was always preceded by an uncomfortable feeling of fullness in the region of the kidney and pain or uneasy sensations at the penis. With the exception of these attacks of pain and distress in the urinary organs, prior to the discharge of the hydatids, he enjoyed good health. He has lost no weight, his appetite is good, and bowels regular.

The specimens consisted of ten or twelve hydatid cysts, ranging in size from a pea to a grape and contained a small quantity of urine. They were evidently the daughter cysts of a larger one which was in communication with the urinary passages. Several of the cysts contained smaller ones (granddaughter cysts). On examination of the urine in which they were, numerous hydatids and hooklets could be seen.

J. I. Russell and E. F. Kilbane's Case

Male, age 46, Italian. Eight days before admission to hospital he had a chill and fever followed by pain and burning in right kidney region. No nausea or vomiting and no urinary symptoms were present other than that patient thought that the

urine was a little darker during the attack, but he had noticed no blood. Upon further questioning after operation, he stated that he had observed small grape-like cysts in his urine. Had this been known before operation, a correct diagnosis should have been made.

Examination showed slight tenderness over the right kidney; no mass could be felt. X-rays were negative. Urine was normal except for a few pus cells.

Cystoscopic examination showed the bladder urine very turbid, the last portion of catheter being thick pus. The bladder mucosa was markedly congested. The left pelvis was easily catheterized and a prompt flow of clear urine was obtained. The catheter passed into the right pelvis very readily but there was no flow of urine although several catheters were used. The fluid injected into the right pelvis to start the flow came back very turbid and contained a large number of pus cells.

Operation. Right nephrectomy was done through an oblique lumbar incision. The kidney was situated very high and the seat of a large semifluctuating tumor with apparently very little, if any, kidney tissue left. Recovery.

The kidney measured 16 by 13 centimeters. About 3 inches of the ureter, which was about 6 centimeters in circumference and very much thickened, was removed with the kidney. The kidney tissue had entirely disappeared and none was recognized microscopically. The entire kidney was occupied by a large echinococcus cyst with daughter cysts, the former communicating with the pelvis.

Louis E. Schmidt's Case

Male, age 21, Greek. The onset of trouble began 7 years ago when patient experienced an aching sensation in the region of the left kidney. The pain did not radiate; no chills or fever; no urinary symptoms. On one occasion the pain increased in severity while voiding urine, at which time the patient passed a globular, jelly-like mass from the urethra. The second attack about 5½ years ago, was similar to first only more severe; at this time patient suffered actual pain radiating from the lumbar region to the glans penis and culminating when a large number of globular masses was passed *per urethram*. Since the second attack, succeeding attacks increased in severity. These attacks were accompanied with severe excruciating pain in the left kidney, left ureter, and glans penis. Patient passed possibly several hundred cysts up to date of operation. He is fairly well nourished; but his strength and general health have failed quite rapidly the last 5 or 6 months.

Operation. An incision was made over the left kidney, exposing the kidney and a tumor. The character and extent of the involvement made nephrectomy imperative. The wound was closed and patient discharged on twelfth day following.

The upper half of kidney was normal in contour and aspect; the lower half was entirely replaced by a cystic tumor, which was roughly spherical but slightly elongated and measured 8 centimeters by 6 centimeters. The renal capsule was slightly thickened and adherent over the whole kidney, but especially where covering the tumor.

On section the upper pole of the kidney presented an essentially normal appearance with normal markings, except that there was moderate passive congestion. The tumor was not multilocular; but corresponded in appearance to an echinococcus cyst. The wall of the mother cyst was 1 millimeter thick; filled with numerous, probably 30, daughter cysts, varying in diameter from ½ to 2 centimeters, with typical thin, pearly white walls, all filled with aqueous fluid. The kidney cortex thinned out over the portion of cyst adjacent to the main mass of kidney. The renal pelvis was involved by a cyst at one point, a daughter cyst of about 1 centimeter diameter projecting into one of the calyces. The orifice of communication between the main cyst was 0.5 centimeter in diameter. The relation of tumor to cortex, the latter thinning out gradually over the former, indicated plainly that the tumor originated in the midst of the lower pole and expanded gradually, giving rise to a pressure atrophy, with, finally, almost complete disappearance of lower half of kidney. The invasion of the pelvis was undoubtedly late and secondary.

A. L. Stavely's Case

Male, age 43, Russian Pole, admitted to hospital March 5, 1889, with intense pain anteriorly, just below the thorax and extending around to the back.

Examination showed patient well preserved, with a very marked prominence of the lower part of thorax and upper part of abdomen. On palpation a large, firm mass could be felt extending about 4 inches below the margin of the ribs. The urine was slightly darker than normal with no albumin or anything else that could be of assistance in making a diagnosis. No jaundice. On April 11, he suffered excruciating pain requiring frequent hypodermics. April 12 he dropped dead on the floor.

Autopsy. On opening the abdomen a large, tense, fibrous sac was seen and found to have liquid contents. All the organs were displaced by it. On feeling for the right kidney, it was discovered that its position was occupied by this enormous body and the kidney could not be found. In trying to remove the cyst, the finger forced its way through a weak spot and more than nine pints of a clear odorless, serous-like fluid escaped; floating in the fluid was found a solitary daughter cyst about 0.5 inch in diameter. The cyst was removed after great difficulty and found to contain a thick, white membranous mass floating in some liquid. The membrane, or more properly the cyst wall, was distinctly laminated and looked something like boiled albumin. One surface, slightly roughened, had here and there an aggregated nodular mass which proved to be echinococci buds. The other surface of the cyst-wall was smoother, covered with thin layers of a jelly-

like consistency, easily detached, and appeared to be of more recent formation.

Microscopic examination of the fluid showed a number of hooklets and crystals of sodium chlorid.

No apparent lesions were found in any other organ except that the heart was somewhat dilated, with some fibrinous deposit about the mitral and aortic semilunar valves.

Report of 3 Cases by Edward L. Young

Case 1. Male, age 34, Italian. Family and personal history were negative. Six weeks ago patient began to have a heavy feeling in the epigastrium; most marked after eating and decreased in intensity until next meal. Ten days ago this feeling changed into a pain confined to the epigastrium. Five days ago the pain became worse, confining the patient to bed. One month ago he had some burning micturition but no hæmaturia or other urinary symptoms. No nausea, vomiting or chills.

Examination was negative except for marked tenderness and muscle spasm in epigastrium, most marked 2 inches above umbilicus. No spasm was present in lower half of the abdomen, which was soft but tender.

Immediate operation. Abdominal incision: nothing intraperitoneal but a mass about the right kidney. A kidney incision was then made and the kidney found to be a large cyst, the cavity extending about 4 inches into the liver. The kidney was removed and the cavity washed out. The wound was drained. Convalescence was normal.

One month after operation echinococcus fixation test was positive.

Case 2. Male, age 23, Italian. Family history negative.

Personal history was negative. As a boy he played a great deal with his dog and was in the habit of sleeping with it. Two years ago he passed one small, colorless bean-like body in urine, accompanied by pain and blood. He felt perfectly well afterward. Five months later he had a similar attack passing several cyst-like bodies; since then he has attacks every 3 to 5 months.

Examination was negative except for the fact that the spleen was easily felt. The patient brought in two unruptured cysts which proved to be broad capsules from an echinococcus cyst. Cystoscopy showed bladder normal and both ureters were easily catheterized; flow of clear urine from each. An intravenous phenolsulphonepthalein test was made and showed an output of 50 per cent in 15 minutes from the right side; 4 per cent from the left side. Cultures from both sides showed no infection. X-rays were negative. Injected X-rays showed an abnormal pelvis. Complement-fixation test for echinococcus positive.

Nephrectomy with normal convalescence; 4 days later fixation test moderately positive; 26 days later fixation test negative.

Case 3. Male, nationality not stated, was transferred from medical service to surgical service with a diagnosis of retroperitoneal tumor. Family and personal history were negative. Patient had pain in upper left quadrant 15 years ago when he noticed a mass. This mass grew slowly until 2 months ago; since then the increase has been very rapid. He has cutting pain in the left upper quadrant, radiating down into thigh. He has been vomiting about twice a week for past month.

Examination was negative except for a rounded tumor filling the left abdomen, extending to the umbilicus on the side and half-way to pubes below. The surface is irregular, and the mass moves with respiration.

Urinalysis: Acid, specific gravity, 1,028; trace of albumin; rare cast; leucocytes and red blood cells present. Wassermann negative. Guaiac on stools, positive. Renal function 15 per cent in first hour. Cystoscopy: normal urine from each side with equal normal function.

Operation. A tumor was found attached to the kidney; nephrectomy. Normal convalescence. Ten and thirty-five days later fixation tests were still strongly positive.

Pathologist's report. The specimen consists of a kidney containing an elongated tongue-shaped mass, measuring 8 by 18 centimeters, attached to one pole. The surface is fibrous and fatty and on section is filled with echinococcus vesicles. Its base is formed by a portion of the kidney cortex, which is completely walled off from the rest of the kidney substance. The rest of the kidney shows nothing noteworthy.

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A HITHERTO UNRECOGNIZED MODE OF ORIGIN OF CONGENITAL RENAL CYSTS[1]

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SPACE does not permit a review of the abundant literature on congenital renal cysts, a condition with which every medical man is more or less familiar. Suffice it to enumerate here the several possible modes of origin which have been suggested by previous authors: (1) the persistence of the "anlagen" or rudiments of uriniferous tubules in the vesicular phase of development and their later expansion; (2) the failure of the S-shaped anlagen of uriniferous tubules to unite with the straight collecting ducts; (3) the failure of uriniferous tubules to join the collecting ducts of higher orders (later generations) after having become detached from such ducts of a lower order; (4) the belated appearance of disconnected cavities in a uriniferous tubule which had remained solid during its formation; (5) the secondary compression of collecting or secretory tubules due to a local inflammatory process, as congenital syphilis, for instance, or other pathological changes. The production of retention cysts by the latter method has been demonstrated sufficiently clearly to occur, but the other possibilities are in the nature of hypotheses, which can neither be denied, since theoretically they are entirely plausible, nor have they been adequately proven. On the other hand, the following observations reveal a process of cyst formation heretofore unrecognized, and the writer's interpretations have the advantage of being based on a series of consecutive embryonic and fœtal stages displaying all steps in the genesis of such cysts and their derivation from an originally normal physiological condition.

Regarding the development of the functional kidney or metanephros, it will be recalled that it has a double origin, the ureter, renal pelvis, calyces, and straight collecting tubules or ducts arising from the so-called ureteric bud, a diverticulum of the more primitive wolffian duct, and the coiled uriniferous or secretory tubules "crystallizing" so to speak, from the metanephrogenic blastema into which the ureteric bud grows. The blind expanded end of the bud becoming the primitive renal pelvis, it now gives rise by sprouting, branching, and rebranching to the different successive generations or orders of straight collecting ducts. During this process, the metanephric blastema, which always caps the ampullæ or blind terminations of the last ducts formed, is divided in such a way that one part is raised or carried peripherally by the newly sprouting ones while the other part stays behind in the form of separate masses which lie in contact with the sides of the parent ducts. As this process is repeated every time a new generation of ducts is produced, generation after generation of potential uriniferous tubules are likewise laid down and accordingly arranged in successive tiers as one proceeds from center to periphery. Soon after those metanephric masses are split off from the blastema, they round out to form what are known as "metanephric spheres." By the acquisition of a cavity they become converted into the "metanephric vesicles." By further growth and change, they attain the typical S-shaped stage, one end establishing continuity with the respective collecting duct, and the other forming the glomerular corpuscle. Continued growth, extension, convolution, and histological differentiation create the definitive characters of the uriniferous tubules. For the details of these genetic processes, as well as the formation of the renal lobules, pyramids, etc., the reader is referred to Keibel and Mall's *Embryology*, vol. ii.[2]

It is stated in embryological texts that the first formed uriniferous tubules open into collecting ducts of the fifth order, but after birth, all uriniferous tubules discharge into collecting ducts of the tenth or higher order. It is generally supposed that this shifting of relations during development is effected in two

[2] Manual of Human Embryology, volume ii. Edited by Franz Keibel and Franklin P. Mall. Philadelphia: Lippincott Co., 1910.

[1] The present study is based on the microscopic examination and study of 26 human embryos and fœtus ranging in age from 6 weeks to 5 months of intra-uterine life, postmortem macroscopic examination of 10 babies and 36 cadavers in the dissecting room. Many of the embryos examined belong to the University of Chicago Embryological Collection in the Anatomical Laboratories.

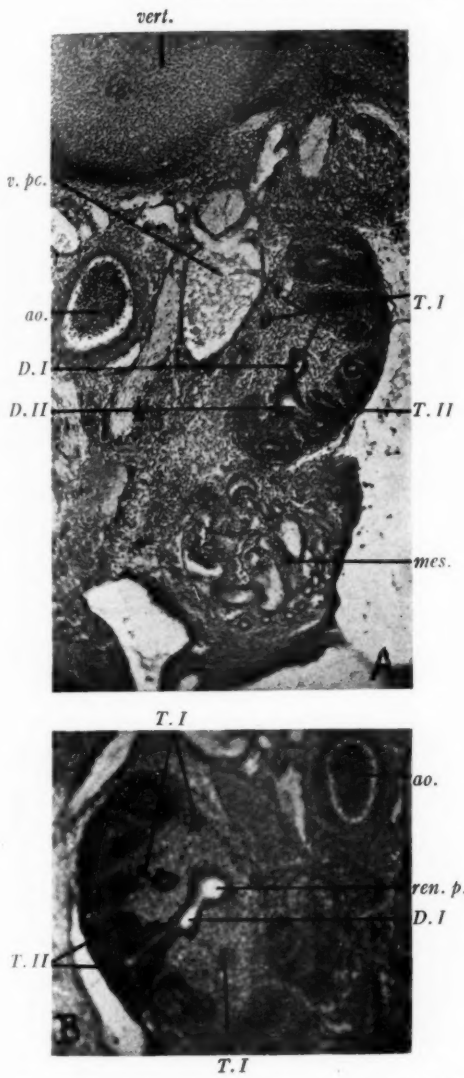

Fig. 1. Photomicrographs of sections through the left (*A*) and right (*B*) kidneys of a 6 weeks' human embryo (17 millimeters). X60. *vert.*, Vertebral column; *ao.*, aorta; *v. pc.*, postcardinal vein; *mes.*, mesonephros; *T. I*, metanephric islands and strands, the rudiments of the vestigial primary generation of uriniferous tubules; *T. II*, anlagen of the secondary uriniferous tubules; *D. I*, and *D. II*, primary and secondary collecting ducts; *ren. p.*, renal pelvis.

ways: (1) by the temporary detachment of a uriniferous tubule from a collecting duct of a lower order and its reunion with a duct of a higher order, and (2) by the peripheral migration of points of junction between uriniferous tubules and collecting ducts due to the progressive sprouting, outgrowth, and elongation of the latter. It is further tacitly assumed by most embryologists, anatomists, and pathologists that degeneration of uriniferous tubules does not normally occur during development.

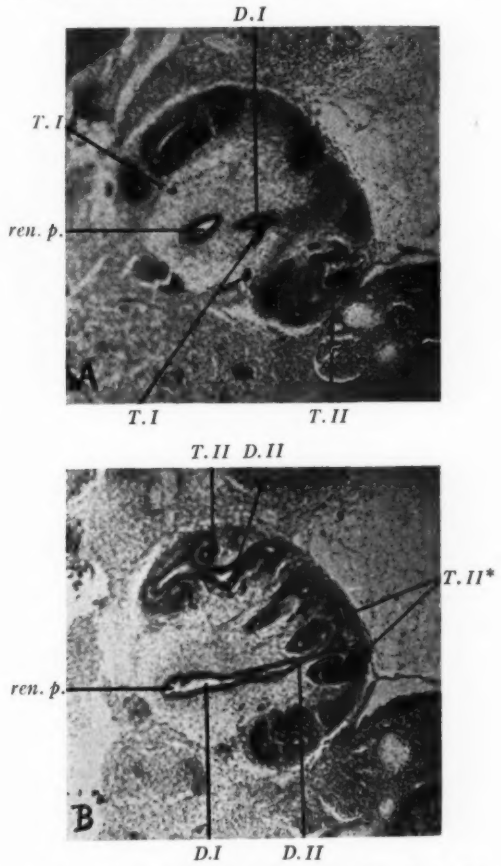

Fig. 2. Photomicrographs of sections through the left kidney of a 6½ weeks' human embryo (21 millimeters). X60. *T. I*, Metanephric islands or anlagen of the vestigial primary tubules, one adhering to primary duct, *D. I*; *T. II*, secondary tubules in vesicular stage; *T. II**, these tubules in S-shaped stage. Other references as in Figure 1.

During the past year, the writer has made several interesting and significant observations in the developing human kidney which have a direct clinical bearing. These can be enumerated as follows: (1) the existence of a vestigial

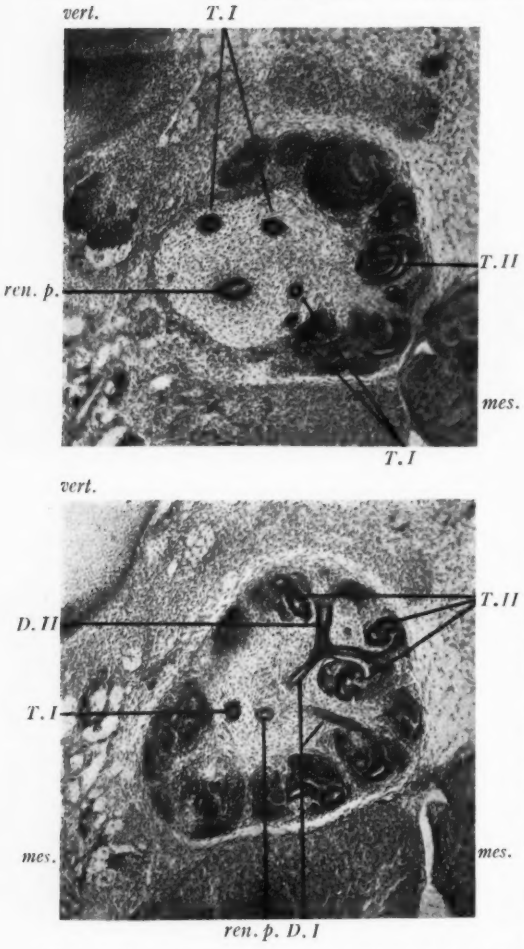

Fig. 3. Photomicrographs of sections through the left kidney of a 6–7 weeks' human embryo (22 millimeters). X60. *T. I*, Vestigial primary uriniferous tubules in vesicular stage; *T. II*, secondary uriniferous tubules. Other references as before.

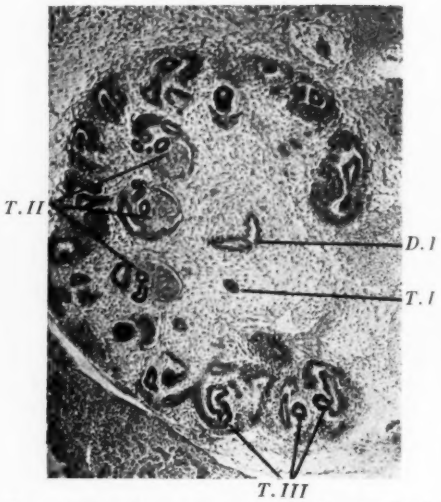

Fig. 4. Photomicrograph of a section through the right kidney of a 7 weeks' human embryo (25 millimeters). X60. *T. I*, Solid rudiment of a vestigial primary uriniferous tubule; *T. II*, secondary uriniferous tubules; note the large glomeruli and the differences in staining reaction of the several portions of the tubules; *T. III*, tertiary uriniferous tubules in vesicular and S-shaped stages. Other references as before.

primary generation of uriniferous tubules; (2) the occasional cystic transformation of such vestigial tubules; (3) the early communication of the next or second order of uriniferous tubules (the first generation of previous authors) with collecting ducts of the corresponding order, namely the second; (4) the temporary detachment of most of these tubules from the secondary collecting ducts and their reunion with ducts of the fourth and fifth orders; (5) the later permanent separation of these uriniferous tubules from those ducts and the cystic transformation of most of them; in other words, the apparently constant appearance of renal cysts at a certain period of fœtal life. During this study, the writer focused his entire attention on the two generations of tubules mentioned, namely, the first or vestigial, and the second or first normally formed generations, the history and fate of which are discussed as briefly as possible in the succeeding paragraphs. It is probable that all or a large number of the tertiary uriniferous tubules meet with a fate similar to that of the preceding ones, although we have not brought together sufficient data to make decisive statements in this regard.

I. THE PRIMARY OR VESTIGIAL GENERATION OF URINIFEROUS TUBULES

At the time when the primary collecting ducts grow out from the primitive renal pelvis and drag or carry away from it the investing metanephrogenic blastema, small isolated fragments and strands of the latter tissue

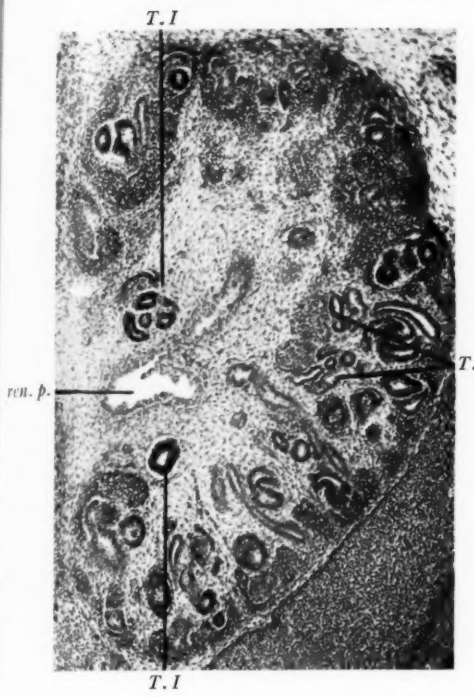

Fig. 5. Photomicrograph of a section through the left kidney of a 7½ weeks' human embryo (27.8 millimeters). X60. *T. I*, Vestigial primary uriniferous tubules, one in vesicular phase, the other tubular; *T. II*, examples of secondary tubules; note their large glomeruli. Other references as before.

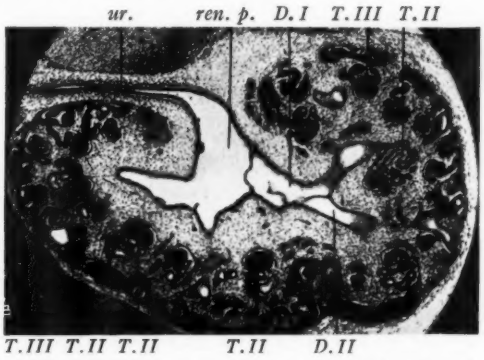

Fig. 6. Photomicrograph of a sagittal section through the left kidney of an 8 weeks' human embryo (29.2 millimeters). X30. *T. II*, Secondary uriniferous tubules; note their large size, especially of their glomeruli; *ur.*, ureter. Other references as before.

lag behind in the embryonic connective tissue near the renal pelvis. This becomes even more evident when the secondary collecting ducts bud from the primary ones. Such detached islands are especially clearly shown in Figure 1, A and B (*T. I*), representing the conditions in a 6 weeks' human embryo. Other particles of the blastema may adhere as spurs (*T. I*) to the wall of the primary collecting ducts (Fig. 2, A).

The majority of these centrally located and isolated islands of metanephric blastema round out and form at first dense solid spheres which become converted into vesicles, in approximately 7 weeks' embryos, as portrayed in Figure 3 (*T. I*). The manner of change from solid sphere to hollow vesicle compares closely with that of normally developing tubules, the peripheral cells of each anlage aligning themselves to form a typical columnar epithelium and leaving a clear lumen after the dissolution of the central core cells. As depicted in Figure 3, these isolated rudiments of potential uriniferous tubules (*T. I*) are medullary in position, the lightly staining mesenchyme of the medullary territory contrasting strongly both with them and the darkly staining cortex. The number of such vesicles belonging to this isolated primary generation is quite variable. In the particular specimen represented by Figure 3, there were eleven in the right kidney and sixteen in the left. Some of these may never get beyond the vesicular phase; the majority, however, continue to grow, elongate, and make a more or less successful attempt at tubular formation (*T. I*, Fig. 5). In this respect a striking difference obtains between this set of tubules and the ones coming after. Whereas the subsequent generations show a monotonous regularity and uniformity in the manner of development, it may be stated as a general rule for the generation under immediate consideration that no two tubules look exactly alike. Some may remain as vesicles during the remainder of their existence; others merely form a short curved segment; still others develop a simple coil without a glomerulus or with only a bare indication of it, while others again, more perfectly formed, may produce such structures, in some cases quite large, in others puny. All such observations indicate that we are here

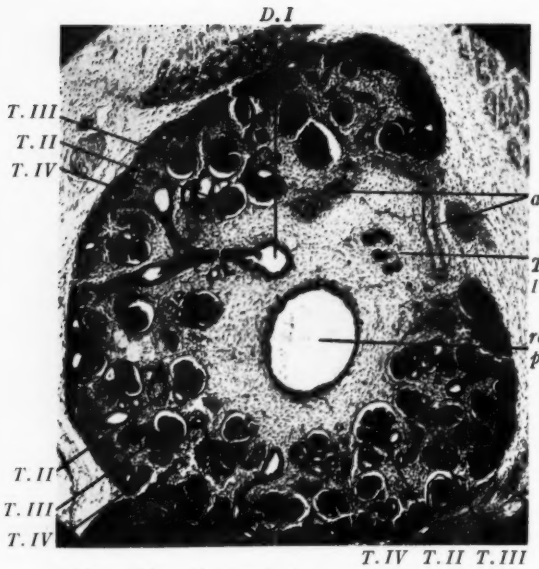

Fig. 7. Photomicrograph of a transverse section through the right kidney of a 9 weeks' human embryo (38.4 millimeters). X50. Note the arrangement in tiers of the uriniferous tubules of the first or vestigial (*T. I*), second (*T. II*), third (*T. III*) and fourth (*T. IV*) orders respectively; *ren. p.*, renal pelvis; *D. I*, primary collecting duct, showing its branching into the following generations of ducts; *arc.*, arcuate vessels.

dealing with an abortive attempt at tubular development. Moreover only two or three of the one hundred or more such tubules ex-

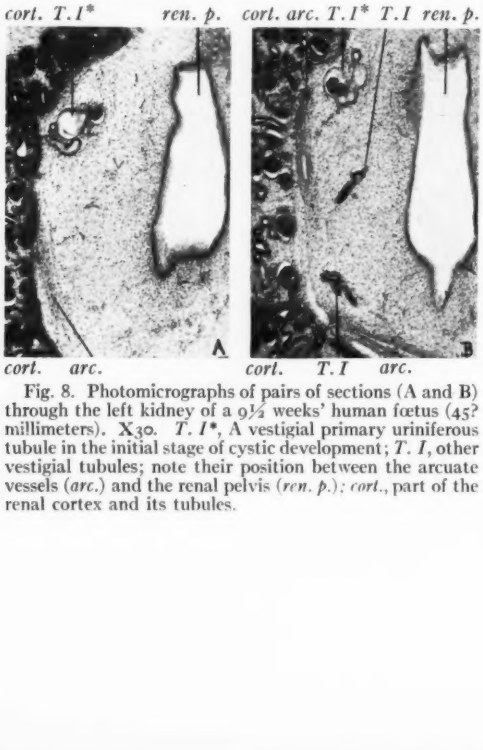

Fig. 8. Photomicrographs of pairs of sections (A and B) through the left kidney of a 9½ weeks' human fœtus (45? millimeters). X30. *T. I**, A vestigial primary uriniferous tubule in the initial stage of cystic development; *T. I*, other vestigial tubules; note their position between the arcuate vessels (*arc.*) and the renal pelvis (*ren. p.*); *cort.*, part of the renal cortex and its tubules.

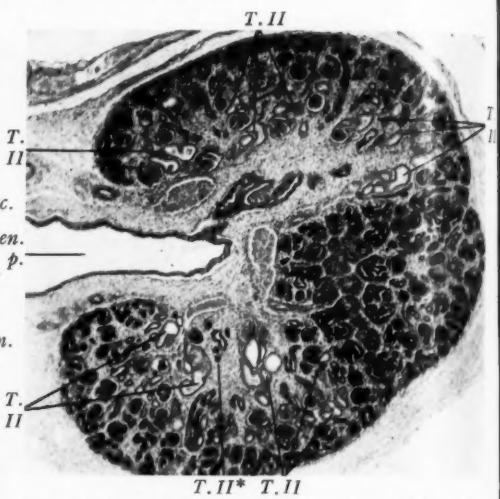

Fig. 9. Photomicrograph of a section through the left kidney of a 2½ months' human fœtus (55 millimeters). X25. *T. II*, Secondary uriniferous tubules in the initial stages of cystic degeneration; *T. II**, a secondary uriniferous tubule degenerating without cystic formation. Other references as before.

amined gave evidence of any histological differentiation, that is, of possessing, besides glomeruli, cellular differences in the several tubular segments. Finally, only one of these tubules had succeeded in making a connection with the collecting system of ducts by joining the renal pelvis by means of a slender, solid, intermediate piece. All the others remained isolated.

The above characteristics clearly demonstrate the vestigial nature of these tubules. Such proof may be briefly recapitulated as follows: (1) the great numerical variability of the anlagen laid down, (2) the stunted appearance of many of the resulting tubules, (3) their lack of histological differentiation, (4) the failure to unite with the collecting ducts. Furthermore, we can maintain that this vestigial generation of tubules in reality represents the primary one, as expressed by the intimate association of some of their earliest anlagen with the primary collecting ducts.

During their entire history, the vestigial tubules are situated in the medullary zone, that is central to the arcuate vessels as shown in Figures 3 to 8. They frequently lie close

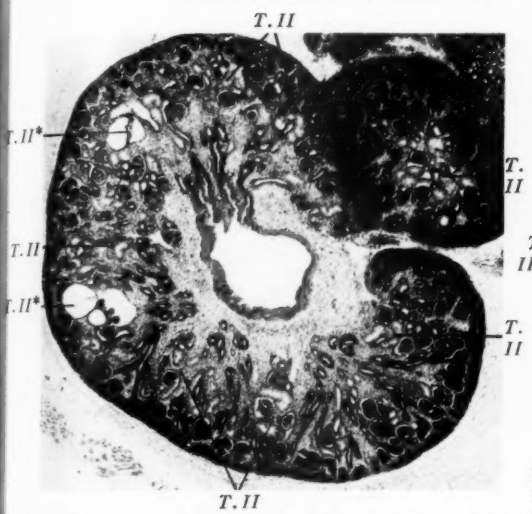

Fig. 10. Photomicrograph of a section through the right kidney of a 3 months' human fœtus (70 millimeters). X25. *T. II**, Two cystic uriniferous tubules of second order; *T. II*, other tubules of this order much enlarged and some in the early cystic stages. Other references as before.

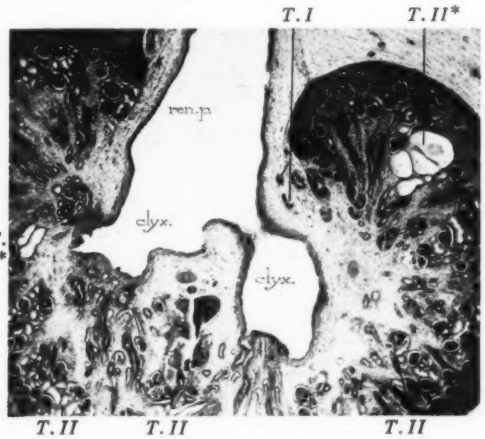

Fig. 11. Photomicrograph of part of a section through the left kidney of a 3½ months' human fœtus (87 millimeters). X20. *T. I*, A vestigial primary uriniferous tubule with a puny atrophic glomerulus; *T. II**, cystic secondary uriniferous tubules; *T. II*, other tubules much enlarged and some in initial cystic stage; *clyx.*, major calyx (former primary collecting ducts) showing entrance of papillary ducts. Other references as before.

to the epithelial lining of the renal pelvis or the major calyces (former primary collecting ducts). A favorite site is the mouth of the renal hilus (*T. I*, Figures 7 and 11).[1]

That such primary uriniferous tubules never become functional in man has been definitely established. At what time, however, they disappear and how they disappear is a problem which can be solved only by a careful scrutiny of late fœtal and postfœtal stages. When the writer studied them in the 2 months' fœtus (Fig. 8), and noticed that they had apparently reached the end of progressive development, he fully expected to find them in all stages of retrogression and disintegration soon after. But in a 5 months' fœtus they are still present and, with the exception of the few that become excessively large and cystic, are not different, it seems, from those of preceding months. In the great majority of cases, no change, either progressive or regressive, is visible throughout a long period. Whether or not these tubules will vanish before the end of fœtal life, or persist as vestiges long after birth, remains an open question; it would not be a matter of surprise to find their epithelial rests in the medulla even of a full grown kidney.

[1] When comparing the size of the uriniferous tubules of early and later stages of development as shown in the photomicrographs, it should be borne in mind that Figures 1 to 8 were taken at a magnification of X60, and Figures 9 to 14 at X10.

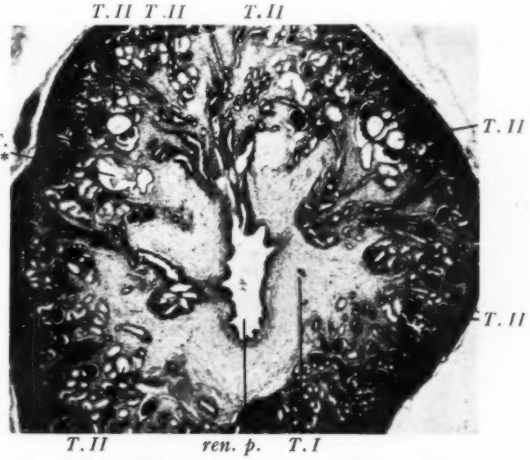

Fig. 12. Photomicrograph of a section through one of the poles of a kidney from a 3½ months' human fœtus (90 millimeters). X20. *T. I*, Vestigial primary uriniferous tubule; *T. II*, numerous secondary uriniferous tubules, some in initial stages, others in more advanced stages of cystic development. *T. II**, beginning collapse of a cystic tubule. Other references as before.

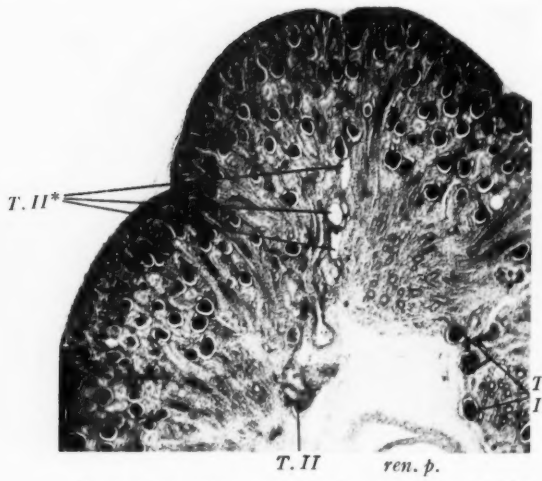

Fig. 13. Photomicrograph of part of a section of a kidney from a 5 months' human fœtus (140 millimeters). X25. *T. II**, Cystic secondary uriniferous tubule compressed by neighboring structures; *T. II*, other more centrally located uriniferous in initial stages of degeneration. Other references as before.

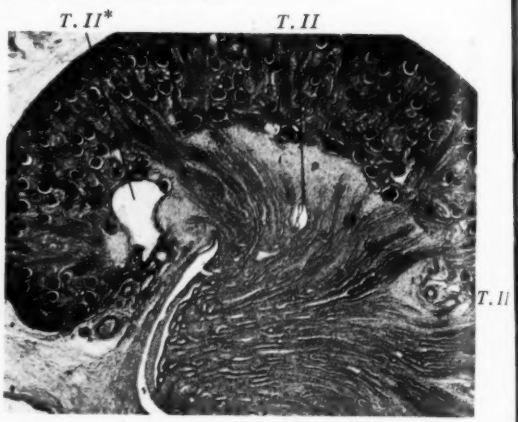

Fig. 14. Photomicrograph of part of a section of the left kidney from a 5 months' human fœtus (140 millimeters). X20. *T. II**, Large cystic uriniferous tubule, the one in the center of the picture showing a collapsed loop of Henle. Other references as before.

That these vestigial tubules may have an important clinical significance is shown by the discovery of their occasional cystic transformation. An initial stage in such modification is pictured in *T. I**, Figure 8, from a 2 months' human fœtus. Here a portion of the tubule is just beginning to distend. In another fœtus, one of 5 months, a later stage in the cystic development of one of these vestigial tubules occurred; it had become very much dilated and was situated near the renal pelvis between the apices of two neighboring renal pyramids. It is easily conceivable how not only a single renal cyst may be derived from it in a kidney otherwise normal, but by its further growth and pressure might readily become the starting point of a progressive formation of cysts involving the entire neighboring portion of the kidney.

II. CONCERNING THE URINIFEROUS TUBULES OF THE SECOND ORDER

In origin, development of form, growth, and early histological differentiation, the uriniferous tubules of the second order show notable precocity. The first ones of these, laid down as metanephric spheres in a 6 weeks' embryo (*T. II*, Fig. 1, A), already have attained the convoluted tubular phase and exhibit segmental histological differences in a 7 to 8 weeks' embryo, as depicted in Figures 4 and 5 (*T. II*) where differences in staining reaction and size of cells already demarcate the several tubular portions. Arising later than the primary or vestigial tubules, these secondary ones may already have acquired such relatively advanced characteristics at a time when the former are just beginning to change from the vesicular to the tubular form. It is true, the discrepancy in the comparative degree of development is partly accounted for by the developmental retardation of the atrophic or vestigial generation, but even when compared with the third order of secretory tubules, the second manifest precocity. In a 7 weeks' embryo, some of the tertiary tubules exist as spheres, but well differentiated tubules of this generation are found for the first time in 9 weeks' embryos.

In contradistinction to the primary or vestigial tubules, each of which differs more or less from every other, the secondary ones for some time show, as already pointed out, a remarkable developmental uniformity not only among themselves but also when compared with the subsequent generations of uriniferous tubules. Their progressive development through the sphere (*T. II*, Fig. 1),

vesicle (Fig. 2), S-shaped (Figs. 2 and 3) and several convoluted stages (Figs. 4 and 7) is a process with which every one is familiar who has acquainted himself, even only superficially, with the embryology of the kidney. Therefore, such a narrative would be superfluous here; for a description of this process, the reader may turn to Keibel and Mall's *Embryology*, vol. ii. But there are two or three features in their genetic history which should be delineated here. In the first place a large number of these secondary tubules, while in the S-shaped stage, temporarily join the collecting ducts of the same order, the second, as portrayed in Figure 2, B (*T. II*). Soon after, most of them develop a small diverticulum at the junction of the intermediate piece (the segment that joins the tubule to the collecting duct) and the potential convoluted segment. This diverticulum grows longer and peripheralward as a slender epithelial cord, and in somewhat later stages unites with a collecting duct of the fourth or fifth order. In the meantime the earlier connection with the duct of the second order is lost. But not all of these tubules behave thus; some retain their original connections until they disappear, for even in 4 to 5 months' fœtus, one observes at times shrunken and atrophic tubules attached to certain collecting ducts just above their opening into the major renal calyces, the former primary collecting ducts.

Another fact should receive particular comment, namely the early excessive growth of the great majority of the secondary uriniferous tubules, especially of their malpighian corpuscles and tubuli contorti. Their progress in this respect is startling, as illustrated in Figures 2 to 7. As actual measurements reveal, an embryo only 2 months old already possesses glomeruli which are equal in size to the largest found in a child of 2 years; in other words, a newborn babe does not have as large glomeruli as a 2 months' embryo. What causes the precocious enlargement of the earlier uriniferous tubules is obscure.

The further increase in size of these enlarged secondary uriniferous tubules is accompanied by certain degenerative manifestations, the inception of which is already unmistakable in a 2½ months' fœtus, as shown in Figure 9 (*T. II*). Here the tubuli contorti are much wider than formerly, and the proximal portions of the intermediate pieces have become considerably distended. These features give the first hint that these secondary uriniferous tubules will degenerate through cystic transformation. As yet, however, there is no indication of dilatation of Bowman's capsule. But all the tubules examined had lost their connections with the collecting ducts, although the remnants of such connections were sometimes visible.

In a later period in 3 to 5 months' fœtus, the cystic distention commenced in the intermediate piece progresses until the whole tubule is involved, as illustrated in Figure 10 (*T. II**). Bowman's capsule also becoming dilated, the glomerulus assumes a more or less flattened form and projects into its cavity as several separate tufts (Fig. 10). As the expansion of the remaining portions of the tubule proceeds, their epithelial lining also becomes more and more compressed and squamous in character. The lumen of such cystic tubules, even in the initial stages of distention, always contains a colloid-like substance of yellowish color, which during fixation contracts and pulls away from one side of the walls. It is shown in the photographs as faint shadows only partially filling the cavities of the cysts. Whether it signifies a product of the disintegrating epithelium or the excretion of a partly functioning but blind tubule, we are unable to say, although the latter possibility seems the more plausible.

The discovery of the large number of uriniferous tubules that normally are subject to cystic degeneration caused considerable astonishment on the part of the writer. For instance, in the 3 months' fœtus studied, approximately forty cystic tubules were counted in each kidney! In the 2½ and 3½ months' fœtus ten or a dozen were found. More fœtus of similar age must be examined before it is possible to state definitely when the numerical height of cystic development is normally reached, but the writer's observations would seem to indicate that this takes place at the end of the third or the beginning of the fourth month of intra-uterine life.

Although the cysts are formed more often between the medullary rays of the developing pyramids, as depicted in Figures 10, 11, 12, and 14, they may also occur in the renal columns of Bertini nearer the renal pelvis. The size which the cysts attain is quite variable. Some may show signs of collapse quite early (*T. II**, Fig. 12), while others may continue to grow very large (*T. II**, Fig. 14). If the cysts disappear as they usually do, this may happen in various ways. The degenerating epithelium may collapse or shrink away from the surrounding mesenchyme, as seen (*T. II**) in Figure 12. Consequently spaces are frequently found which contain in their lumen spurs or vestiges of the former epithelium. In other cases, the walls may not collapse, but the cyst becomes progressively compressed by the growth and crowding of the normal structures on both sides of it (*T. II**, Fig. 13).

The above observations indicate *that every human individual during his fœtal life normally passes through a period characterized by the presence of numerous cystic renal tubules*. Such a normal physiological event, however, may be converted into an abnormal or pathological condition if such tubules do not give way at the end of their allotted time but continue to grow (Fig. 14) and expand to the detriment of adjacent normal structures. Should one do this, it is readily understood how it may produce a large renal cyst, so frequently found in postmortem examination of the kidneys of infants as well as adults. During the past academic year, the writer inspected the kidneys of 36 cadavers in the dissecting room, and in five of them observed one or two renal cysts varying in diameter from 5 centimeters to 2.5 centimeters. He also made postmortem examination of ten babies, ranging from fœtus near term to infants several months old, and found in a newborn one kidney which contained several small cortical cysts measuring from 1 to 2 millimeters across. It has always been maintained that such cysts had their beginning either from an anlage of a uriniferous tubule which had failed to unite with its collecting duct, or resulted after a localized inflammatory process had obliterated a segment of a tubule or duct. The potency of such possibilities is not disputed, but in view of the normal physiological occurrence of the very numerous cystic tubules during a certain period of fœtal life of every individual, as described above, it is more reasonable to assume that more often renal cysts are produced by the persistence and expansion of cystic tubules which had failed to collapse.

It is also conceivable how not only isolated renal cysts, but also congenital cystic kidneys, where the entire organ is affected, a condition not at all infrequent, might have their inception in the cystic degeneration of the uriniferous tubules herein described. At least, a picture like that in Figure 12 is very suggestive. Should all the tubules (*T. II*) which have entered the initial phases in cystic formation continue to grow and distend at the same time, the increasing pressure upon the neighboring normal tubules would interfere with their normal genetic course and confluences and accordingly subject a greater number of them to the same alteration until the entire or greater part of the kidney is affected.

Which factor controls the normal degeneration and suppression of redundant structures is obscure. That such a factor exists seems to be indicated by the fact that the abnormal growth of some structures which should normally disappear, or undergo reduction, or at any rate remain passive, may not only occur in one but in several organs as witnessed by the frequent association in the same individual of renal, hepatic, pancreatic, or genital cysts.

UTERINE SECRETION—AN EXPERIMENTAL INVESTIGATION INTO ITS EFFECT UPON COAGULATION OF THE BLOOD[1]

By ISIDOR KROSS, M.D., New York
Adjunct Gynecologist, Mt. Sinai Hospital

ONE of the most important problems confronting the gynecologist is that of functional or essential uterine bleeding, a name given to that type of abnormal bleeding for which we have as yet found no definite etiological factor. It is quite obvious that before we can explain this pathological condition, we must first know the cause and the mechanism of normal uterine bleeding or menstruation.

The most striking feature in normal menstruation is the phenomenon of a uterine hæmorrhage that runs a strictly limited course in spite of the apparent incoagulability of the menstrual blood. Some investigators, among whom may be cited Blair Bell (1), believe that the absence of fibrin ferment is responsible for this phenomenon. Cristea and Denk (2) claim that the normal fibrin ferment resident in body blood is abstracted therefrom by the uterine mucosa. Schickele (3) showed that uterine extract retards the coagulation of blood. Similar experiments performed by Blair Bell led that investigator to conclude that the extracts obtained from uterine mucosa and from whole uterus did not interfere with the coagulation of blood. Dienst (4) holds that the responsible factor in the non-coagulability of menstrual blood is the anti-thrombin formed by the uterine mucosa. This, he explains, neutralizes the action of the fibrin ferment and thus prevents clotting. On this same basis he explains excessive bleeding as due to an excess of anti-thrombin. Whitehouse (5) in a series of careful and thorough clinical tests and observations, found that clotting always occurs in the uterine cavity containing normal endometrium. His investigations failed to show any excess of anti-thrombin in the menstrual blood or in the endometrium. He explains the presence of fluid blood in the vagina as due to autolysis of the uterine blood clot during its passage downward, as the resultant activity of a fibrinolytic or thrombolytic enzyme. In a bio-chemical investigation of the uterine mucosa, Halban and Frankl (6) found that when pieces of blood free endometrium or emulsions of blood free endometrium were added to serum plates or to milk agar plates, digestion of the proteid constituents of these culture media occurred. They found this tryptic ferment invariably present in the mucous membrane of the uterus (human) during the premenstrual period, frequently in the interval period, and only when pathological conditions were present, did they find this ferment in the postmenstrual period. As far back as 1898, Bond (7) showed that in animals, the uterus had a definite distinct secretion.

In a series of preliminary experiments with human endometrium, the writer tested the effects of the extract upon coagulation of human blood. Extracts made with saline solution and with distilled water were employed. The results obtained were inconstant and contradictory, due in all probability to the presence of both blood and tissue juices. Stimulated by the work of Bond, the writer decided to approach the problem from the animal experimental side to determine its effect upon the coagulation of blood as a step in the solution of the problem of pathological uterine hæmorrhage.

In this study, eighteen young female rats were used. The technique pursued was quite simple. A median suprapubic incision was made, exposing the uterus. In one-half of the animals, a silk ligature was tied around the uterus below its bifurcation; in the other half, the ligature was placed around one horn of the uterus just above the bifurcation. After a period of 2 weeks a second laparotomy was performed and the uterus was examined. In a number of instances this period was not long enough for a sufficient amount of secretion to accumulate. In these cases, the animal was again examined within 1 to 3 weeks. In some animals the uterine secretion was ex-

[1] From Columbia University, Institute of Cancer Research, F. C. Wood, Director.

TABLE I.—SUMMARY OF RESULTS OBTAINED IN EXPERIMENTS

Rat No.	Control Blood		Blood and Uterine Secretion			
	Coag. Time Minutes	Incubation	Coag. Time Minutes	Incubation	Days Past Operation	
A′	1½	Solid clot	4	Completely dissolved	28	Clear
A′	2½	Solid clot	4½	Completely dissolved	36	Clear
A′	1	Solid clot	1½	Completely dissolved	51	Blood
A′	1	Solid clot	1½	Completely dissolved	52	Clear
A′	2	Solid clot	6	Completely dissolved	52	Blood
B′	½	Solid clot	¾	Completely dissolved	36	Clear
B′	½	Solid clot	¾	Completely dissolved	36	Purulent
D′	1	Solid clot	4	Completely dissolved	28	Clear
D′	½	Solid clot	1½	Completely dissolved	36	Clear
E′	¾	Solid clot	3½	Completely dissolved	28	Clear
F′	½	Solid clot	1½	Completely dissolved	28	Clear
F′	½	Solid clot	1¼	Completely dissolved	36	Clear
F′	1	Solid clot	2	Completely dissolved	51	Clear
F′	1	Solid clot	2	Completely dissolved	52	Blood
M′	2	Solid clot	8	Completely dissolved	98	Clear
N′	1½	Solid clot	5	Completely dissolved	98	Blood
O′	1½	Solid clot	2	*Partly dissolved	98	Clear
R′	1	Solid clot	1½	**Partly dissolved	98	Clear

*About one-fifth. **About one-half.
N. B. Human blood.

amined as many as two and three times on separate occasions. In the successful cases, there was readily seen a marked distention of the uterus—either complete or half, depending upon the location of the ligature. In most of the animals, the distention was produced by a clear opalescent fluid. In three the fluid was distinctly blood-tinged and dark and smoky looking in appearance. In another, the fluid in one horn of the uterus was frankly purulent. In the non-successful cases, there was no distention of the uterus and no apparent change in its appearance. In two of the animals, O′ and R′, the uterine distention was extremely slight and the quantity of fluid obtained very small. By means of a fine aspirating needle, the secretion was removed from the uterus and one-half to one cubic centimeter poured into a test tube. Blood was now taken directly from the heart of the same animal or from that of another rat of the same breed. Later on in the course of the experiments, blood from guinea pigs and human blood were employed, and the results obtained were uniformly similar. As soon as the blood was obtained, one-half was added to the uterine secretion and the remainder was used as a control. The coagulation time was now recorded. The blood was considered fully coagulated when the fluid within the test tube was completely solidified as shown by holding the tube upside down. After coagulation had taken place, both test tubes were put into the incubator and examined on the following day.

From the data as given in Table I, it is readily seen that in every instance except O′ and R′, the two cases mentioned above, there occurred (1) a distinct interference with the coagulation of the blood as is evidenced by an increase in the coagulation time, (2) a complete fluidification of the blood clot in all the specimens containing uterine secretion. It is most interesting to note that at the third laparotomy in rat A′, made 51 days after the primary operation, the right half of the uterus was distended with bloody secretion and the left half with clear secretion. The amount of fluid in the right horn was so great that part of it was tested against human blood. As noted in Table I, the addition of this secretion to the human blood increased the coagulation time from 2 minutes to 8 minutes. Another point of interest in this animal consists in the fact that 15 minutes after coagulation had occurred in the blood and secretion mixture, it was noticed that complete fluidification of the clot had taken place.

From these experiments, one is justified in concluding that the uterine secretion in rats contains a substance or substances that have the power of delaying coagulation time and of dissolving blood clots. As for those instances where the uterine secretion contained blood, the writer offers two possible explanations: (1) injury to the blood vessels during the ligation of the uterus resulting in an intra-uterine hæmorrhage; (2) digestion of the superficial endometrial blood vessels by the proteolytic ferment with resultant hæmorrhage. The latter is in line with the theory as advanced by Halban and Frankl (6). These authors maintain that the tryptic ferment of the endometrium by its digestive action causes (1) the decidual swelling of the stroma cells; (2) the destruction of the superficial epithelium; and (3) the erosion of the superficial endometrial vessels with the resultant flow.

Taken in conjunction with the work of Whitehouse, Halban and Frankl, etc., the results of these experiments justify the theory that the cause of abnormal uterine bleeding,

not accounted for on anatomical grounds, i.e., neoplasms, etc., lies in a deviation from the normal physiology of the secretion formed in and by the uterine mucosa. That this in turn is controlled by the ovary either in whole or in conjunction with other glands of internal secretion is most likely the case, and by definite advances in our knowledge of the physiology of these organs will we be able to solve this problem and others associated with it.

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THE SURGICAL IMPORTANCE OF IODINE IDIOSYNCRASY AND POISONING

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IODINE is a disinfectant for skin and open wounds commonly used by the laity and the medical profession. In rare instances, a patient may have an idiosyncrasy for the drug and its use produces symptoms varying from a local lesion to death. Recently at the Massachusetts General Hospital I observed a fatal case, and it seems to me worth reporting with a survey of the literature.

Idiosyncrasy, or allergy, is a familiar term which we can define for this paper as the production of symptoms analogous to the toxic symptoms of iodine, caused by such doses of the drug as are usually considered harmless. The word iodism is also used by various writers almost synonymously with allergy.

LITERATURE

Reports in the literature are largely of cases resulting from the ingestion of iodides, with rare cases of iodine used externally. Most papers date from 1850 to 1900 although we are told Coindet (5) first used iodine as a therapeutic agent in 1820 and that Ricord in 1839 mentioned cutaneous eruptions from potassium iodide and in 1842 saw the same drug produce "a veritable purpura hæmorrhagica" (19). Knowles (5) in 1910 divided the iodide cases into two provisional groups: (1) the extensive petechial hæmorrhagic, bullous cases occurring in individuals with organic disease, chiefly of the heart or kidneys or with a lowered condition of the general economy making them more susceptible to the effect of the drug or with a story of idiosyncrasy to the same. (2) Those cases showing localized distribution of lesions occurring in patients in perfect health on occasions which can be explained only on the theory of mild idiosyncrasy. Sex and age have nothing to do with the occurrence. The physical reaction of the individual to the drug and not the quantity ingested decides the question.

PHARMACOLOGY AND PHYSIOLOGY

The action of iodine and its salts, the iodides, is essentially identical, Cushny (13) remarking: "Iodine is absorbed in the form of iodides and perhaps in combination with protein," and elsewhere: "In contact with the tissues, iodine and protein compounds result." The fate of iodine in the body is precisely similar to that of the iodides, and it is excreted in the form of iodides. Hence the literature of the iodides applies to iodine. This is not true of iodoform, the symptoms from which are in part dependent on the methyl group and therefore not within the scope of this paper.

Regarding the absorption of iodine, Peterson and Haines (1) state: "When applied by surgeons freely to absorbing surfaces, it (iodine) may cause systemic disturbances."

Likewise Cushny (13) says: "It (iodine) penetrates into the deeper layers of the skin and small quantities are absorbed" and idiosyncrasy gives symptoms after small doses. The choice of iodine as a disinfectant is due in part to this very penetrating power. Applied to mucous or serous surfaces it is more readily absorbed (13). If the drug is applied locally without incision we get absorption, but if an incision is present, absorption is greater because of the raw surface. That the symptoms are not due to an impurity of the drug is proved by reactions where a drug known to be pure was used (13). Iodine is a powerful counterirritant (17), and the physiology of its use is chiefly increased blood supply which in turn means increased removal of products from the part and greater absorption of the drug. The pathological changes in the skin (5) are noted in the immediate vicinity of the blood vessels and in the walls of the vessels themselves, the leucocytes playing a distinct rôle in the absorption of the drug.

Iodine is excreted (3) chiefly through the kidneys and the saliva but also through the stools (22), skin, and sweat glands (5). Ingested iodides have been eliminated as pure iodine by the gastric mucosa (14, 19, 21). Normally excretion is rapid.

HEREDITY

There are few recorded cases of allergy to the same drug in parent (9) and child as well as in sisters (8), in some present at birth, in others developing after periods of intermittent exposure to the drug. Regarding iodine, there is no literature to prove this is specifically true. Logically it might well be so.

CLASSIFICATION

Knowles' (5) satisfactory classification is based on whether the patient has organic disease or not. Personally I prefer to classify by symptomatology and divide the cases into two great classes: (1) systemic symptoms in varied severity, without skin symptoms; (2) cases with skin lesions, which we must subdivide into (*a*) local lesion with or without systemic symptoms; (*b*) acneiform type with or without general symptoms; (*c*) bullous type; (*d*) purpuric type.

DOSAGE REQUIRED

The literature is often indefinite and refers chiefly to the iodides. The consensus of opinion is that a very small dose can produce the reaction (11), and this makes the entry of a small amount through the skin a perfectly logical etiology for certain cases. The physical reaction to the drug and not the dose is the important factor (10). Peterson and Haines consider (1) 1 fluidram of the tincture of iodine the fatal dose; Cushny says (14) 0.20 grams is the quantity of iodine giving severe effect. The minor eruptions (4) are more frequent from smaller doses of 5 to 10 grains of the iodide, and they sometimes disappear when the dose is increased. In *industrial medicine* (26) ingestion of iodine fumes has caused typical chronic and acute poisoning.

SYMPTOMATOLOGY

Bastedo (4) very satisfactorily sums up untoward actions as:

1. Skin lesions, such as acne; urticaria; or vesicular, bullous, or hæmorrhagic bullous, or purpuric eruptions or disseminated bright or dusky red, painful nodules (6, 7, 4, 11).

2. Irritation of mucous membranes, the symptoms resembling a severe cold in the head or influenza, œdema of the glottis, and swelling and inflammation of the parotids.

3. Iodide fever, characterized by albuminuria in some cases, fever, and eventually delirium. One of his cases had a similar reaction a year previous following iodides. Konried reported two cases from local use of an ointment.

4. Chronic iodism.

MECHANISM OF THE IDIOSYNCRASY

Coca (8) maintains that the drug allergy or idiosyncrasy is not essentially different in underlying mechanism from idiosyncrasies to the non-medical substances. Iodine hypersensitiveness exists, it being exhibited to iodides. The allergy usually appears in a few hours after administration but may appear after intervals of 5 to 20 days following primary injection. Symptoms (14) may not occur on the first dose but later appear for no apparent reasons. The allergy (8) is specific for a drug or group of drugs. The whole explanation of idiosyncrasy is *sub judice*.

OPTIMUM CONDITIONS

Damage to the heart or the kidneys favors the reaction, really because injury to these organs means slow excretion. Similarly patients in poor general physical condition are more likely to show the symptoms. Then there are those who have a definite idiosyncrasy (15), either congenital or acquired (26). Just where to say a patient is simply poisoned by a quantity of the drug and where definite idiosyncrasy is to be blamed is a matter of degree, and I feel that except in large doses we must prefer the term idiosyncrasy, for the terms poisoning or iodism are looser and less accurate although somewhat synonymous. Any case giving toxic action from doses ordinarily considered safe should class as allergy.

TYPE CASES

Systemic type. The cases of Regnard and Simon (20) commented upon by Wood (19) showed definitely pathological urine with albumin, blood, and casts, autopsy disclosing hæmorrhage into the tubules, after external application of preparations containing iodine. Complete anuria may occur (22). Culpepper (23) described a case where 2 drams of some iodine preparation were applied to both legs of a child of 11 years for probable eczema. Local pain began at once, followed in 24 hours by headache, lumbar and general abdominal pain, and diarrhœa. The fæces gave positive iodine test with starch. The stools were almost pure blood the fifth day. The child died on the sixth day. The temperature was never over 98.0. Anuria and priapism existed for some days. The stools were dysenteric for the last 2 days of life. The intellect was clear to the last. Giddiness was felt on any movement. The lungs were resonant. In the severely toxic cases the application of iodine (1) has caused headache, dizziness, mental trouble, along with gastric symptoms such as pain, vomiting, purging, extreme thirst, fainting attacks, and collapse. The elimination by the kidneys involves that organ in inflammation.

Skin lesion. Perhaps the common iodine burn. Iodide rash occurs occasionally.

Skin lesion plus systemic symptoms. Rose's case (13) of poisoning from the injection of an ovarian cyst with iodine showed thirst, constant vomiting (the matter containing iodine), cyanosis and coldness of the skin, small weak pulse, anuria, and skin eruptions after a few days, death occurring on the tenth day. In such cases the mucous membrane of the stomach and intestine has been found swollen and in animals fatty degeneration of liver, kidneys, and heart are found. Rose's case closely resembles in symptoms the M. H. case described later in this paper.

The best authenticated case is that reported by Bryan (23, 24):

"A prostatectomy was done upon a man of 52 who had an idiosyncrasy for iodine poisoning. The abdomen was prepared as usual with iodine, for suprapubic drainage. He developed within 24 hours evidences of an acute intoxication, urticarial rash, cerebral upset, moderate anuria, and evidences of an intense intoxication. I was almost afraid at one time we would lose him. Subsequent history revealed the fact that infection of his arm had been treated with iodine. On one application his life was practically despaired of on account of a similar poisoning. It was the usual 50 per cent preparation of iodine that was used and it was the only instance I have had in a fair experience with such an idiosyncrasy."

Bullous type. This type is often combined with the purpuric type. Knowles (5) mentions a hæmorrhagic bullous type, the eruption being in several patients somewhat generalized on the face and extremities (particularly the arms); others mention the legs as being more commonly involved. Cases of extensive distribution of this type are frequently fatal, 7 out of 11 of the series ending fatally. Minot and Lee (15) observe that "Iodine is one of the drugs that most commonly produces purpura in man especially when the kidneys are injured. Purpura due to this cause tends to be characterized by hæmorrhagic blebs, especially about the fingers. Sutton (9) and Ormsby (10) mention iodine as a cause of skin lesions, the latter describing a fatal case with bullous eruption after ingestion of potassium iodide as reported by Hallopeau. Hyde (25) saw three similar cases with lesions on face, trunk, and limbs, all recovering.

Purpura. The previous type is very similar. Ormsby (11) believes: "A comparatively small dose of iodide may lead to extensive

purpuric rash. Pratt (12) says: "Iodine heads the long list of drugs that may, under exceptional circumstances, produce purpura, the iodides not doing so except in the presence of marked idiosyncrasy." He found not a single case of iodic purpura in 4 years' records in the Outpatient Department of the Massachusetts General Hospital nor did I have any greater success in going over all the house record cards there this year. All forms of drug purpura are rare. Pratt mentions a case at the Boston City Hospital given 180 grains of potassium iodide in 4 days. As a result the fingers were swollen and covered with large hæmorrhagic blebs. Lesions on the tip of the nose and over the thighs developed after 4 days. Osler's clinical records contain a case of acute febrile purpura (12 and 18) due to iodine, here showing an extensive urticarial rash associated with purpuric spots. Lesions of drug purpura are said to show greater tendency to become gangrenous than purpura from other sources. Stelwagon (7) notes that iodine has caused purpura fulminans which consisted of profound cutaneous disturbance, hæmorrhages from the mouth and stomach, intestinal symptoms, general symptoms of collapse, and rapidly fatal ending.

The following case from the Massachusetts General Hospital inspired this study and I report it through the kindness of Dr. Porter and Dr. Greenough.

W. S. 246437. A man of 55, white, married, manager by occupation, was admitted for gastric study with the additional diagnoses of left inguinal hernia and enlarged prostate. The family doctor knew of no previous iodine therapy. The family history was absolutely negative; no hæmophilia. Patient has a wife and 5 children living and well. One child died from peritonitis.

Past history. General health has been "tough and rugged." He had scarlet fever and whooping cough in childhood. He has had rare attacks of sore throat with cold. Cardiorespiratory and gastro-intestinal systems negative up to present illness. He urinated two to three times a day and sometimes twice at night. On two or three occasions the stream had stopped suddenly in the middle of urination, and there had been some loss of size and force of stream. Gonorrhœa was followed by gleet 33 years ago. The patient was told he had a stricture but he had no symptoms from, nor treatment of, the latter. He denied syphilis. He attributed loss of 25 pounds in weight in last year and half partly to overwork.

Present illness. He had gone downhill steadily during the past year. Eleven months before entry he first noticed a distressing faintness and dull epigastric pain 3 to 3½ hours after eating, usually about 10 a.m. and 3.30 p.m. These symptoms were at once relieved by food or soda and rarely appeared unless he was working hard. Six months before entry the man began to be nauseated and vomited with onset of symptoms. This relieved the pain. Vomiting was not constant but appeared for 2 to 3 weeks and then did not occur for some time. He had not vomited for 4 to 5 weeks until the day of entry. Symptoms were accompanied by a moderate amount of gaseous and sour eructations. At noon, 1 week before admission, after hard work, he had an onset of the usual epigastric pain which could not be relieved and which persisted on entry. This pain radiated to the back and was relieved in part by prone position. He vomited on the morning of entry. He had never been on a diet. He had never noted hæmatemesis, tarry or bloody stools, nor jaundice. He had never bled for an unusual time following an injury.

Physical examination showed a fairly well developed and nourished man, lying in bed. The skin was slightly sallow, soft, dry, clear, loose as if from moderate and recent emaciation. The head was negative except he had false upper teeth, fair lowers. No adenopathy. Expansion of the chest was equal. Lungs were resonant throughout with a few scattered, dry râles in the left back, just median to the upper scapula. Heart and pulse were normal. Abdomen was level, slightly tense, tympanitic, with an indefinite sense of fullness to palpation in the epigastrium suggesting mass. No spasm nor tenderness was elicited. No viscera were felt. The genitalia were negative. A small left inguinal hernia could be demonstrated. Multiple small scars were present on the lower third of the left leg, from old injuries. Reflexes were entirely normal. Rectal examination showed a tight sphincter with symmetrical, moderately enlarged prostate which a genito-urinary consultant later considered normal. Temperature, 99°–98°; pulse, 68–80; respiration, 20–24; blood pressure, 144–90.

Ward notes. November 18, day of admission: In bed, comfortable, with no symptoms. November 20: General appearance improved. Gastric test meal showed free and total acidity within normal limits; no gross, microscopic, nor occult blood in either meal. November 22: Gastro-intestinal X-rays negative and normal, both meal and enema. Blood Wassermann negative. November 23: Vomited with slight blood stain. November 24: Probable diagnosis of chronic appendicitis with hyperchlorhydria was made and operation advised.

November 28: Operation. Ether. Wide preparation with half-strength tincture of iodine. Exploratory laparotomy. Bassini repair of left inguinal hernia. Exploration and resuturing of abdominal wound for hæmorrhage. Patient was under ether from 10.40 a.m. to 1 p.m., the operations lasting from 10.50 to 1.5. Eighteen ounces of ether were

used. Pulse, 100–98; respiration, 24–22. The abdomen was opened through a 6-inch mid-rectus incision, considerable bleeding occurring from transverse bands. The gall-bladder was negative. Pylorus was felt; no induration in duodenum. No adhesions. The appendix retrocæcal with tip high in abdomen; removed, and pathological report normal. The wound was closed in layers after some difficulty in identifying the rectus sheath. Bassini repair of the hernia was done next. Hæmostasis throughout was unusually careful because of the trouble in the abdominal wound. After the herniotomy a large raised hæmatoma was noted in the abdominal wound, and this was opened after new table toilet and new local application of iodine. A bleeding point in the fat was tied with stitch-ligature and the wound reclosed. Plain catgut was used for small vessels, chromic for important vessels. Patient went to the ward in good shape.

During the afternoon and evening of the day of operation the pulse increased in rate with decreasing quality. No bleeding was seen, the resuturing of the wound having stopped this. At 3 p.m. the temperature was 101.6°; pulse, 140; and respiration, 25. Patient was not particularly restless. At 11 p.m. shock treatment was begun. November 29: Temperature, 101.2°; pulse, 134; respiration, 16 at 3 a.m., but condition was becoming worse and blood pressure fell to 50. Placed on the danger list at 8 a.m. Mentally alert. Transfusion was considered but he gained during the day, pulse being 100 and respiration 20 at 7 p.m. He was catheterized during the afternoon as he had not voided. This day's output of urine was 15 ounces in spite of a 50 ounce fluid intake. Blood pressure, 80–40. November 30: Continued improvement. Pulse 100 and fairly strong. The wound showed nothing but the remains of the hæmatoma. December 1: Improvement was so great that he was placed in the open ward. December 2: He was irrational during the night. Fair condition otherwise. Mentally alert. Pulse good. Fluids forced. December 3: Definite change for the worse. He was out of bed twice during the night, not well-oriented, and talking irrationally. Pulse was good but appearance worse. About this time the hernia wound, previously normal in appearance, began to assume a purplish color hitherto seen only in the rectus wound and from both wounds the coloration spread peripherally and continually, but slowly. Temperature, 99.2°–101.6°; pulse, 100–110. December 4: Transferred to a room and again placed on the danger list. He was much worse, irrational, fæcally incontinent, and this last condition persisted. On both lower limbs were a few hæmorrhagic blebs, first on the great toes, and then variously over the anterior aspects chiefly. A large hæmorrhagic bulla was seen on the dorsum of the left foot. In the afternoon his condition was so serious that he was given 500 cubic centimeters of whole blood intravenously. Pulse before and after was about 100. Temperature at 3 p.m. was 101°, at 11 p.m. after transfusion it was 98.8°. The arm was prepared with half-strength [tincture of] iodine, at once carefully removed with alcohol. December 5: Temperature rose from 99° in the morning to 101° at night; pulse, 100; respiration 25, rising to 35. Mentally he was much clearer. The purpuric spots in the rectus region had spread definitely during the past 2 days. A medical consultant said: "Condition suggests low grade infection, basis of blood clot. Probably not purpura due to iodine since no other iodized areas have shown trouble." In this connection we should notice that iodine at the transfusion was immediately and carefully removed with alcohol. About this time a small spot of half-strength tincture of iodine was painted over the mid-sternal region and at death and at necropsy this small spot showed a little purplish coloration. That night the patient was in fair condition, the effects of the transfusion persisting somewhat. Renal function 65 per cent, but 25 minutes overdue. The kidneys, therefore, seemed to be functioning fairly well at this time. The fluid chart is shown below. Stool was watery, dark brown, with definite blood. December 6: Very little change in the morning. Temperature, 101.6°; pulse, 120; respiration, 36, so that temperature, pulse, and respiration were rising. Patient was much weaker in the afternoon, but the pulse continued of fair quality, about 120. Facies was shrunken, depressed. Patient became semicomatose. Intravenous digitalis had no effect. Further transfusion was considered. The purplish blebs had extended more widely and most of the abdomen was purplish in color. December 7: The incontinence and irrational condition persisted. The patient became steadily worse and died. The addition to the bullæ and abdominal coloration, purple petechiæ were scattered over thorax and slightly on the face. Necropsy was obtained. Laboratory notes in addition to above showed the urine to be absolutely negative on November 20 and 30 and on December 1 and 5. November 24, stool negative, no blood; December 6, watery, brown, with definite blood. November 29, blood-clotting time was 6 minutes and 7½ minutes in 2 tubes. December 5, bleeding time was 6½ minutes. December 6, non-protein nitrogen of blood 33.6 milligrams per 100 cubic centimeters.

	Red count	Hæmoglobin	White count
November 29	4,800,000	70	7,200
November 30	2,950,000	60	.....
December 4	1,800,000	..	.....
December 4	1,900,000	40	36,000
December 6	3,020,000	60	21,400

Blood smears, November 29, showed polymorphonuclears, 65; mononuclears, 3; lymphocytes, 32; slight achromia. December 4: Polymorphonuclears, 70; mononuclears, 6; lymphocytes, 17; eosinophiles, 1; myelocytes, 5 per cent. Polychromatophilia and achromia; nucleated reds 6.5 per cent.

Fluid intake and output.

	Ounces in	Out		In	Out
November 29	50	15	December 3	60	..
November 30	95	58	December 4	60	..
December 1	95	70	December 5	76	..
December 2	90	45			

Necropsy, December 7, No. 4276, 11¾ hours post-mortem. Anatomical diagnoses: Ulcer and adenocarcinoma of the stomach with hæmorrhage into the gastrointestinal tract. Metastases into the retroperitoneal lymph glands and vertebræ. Purpura hæmorrhagica. Anæmia. Operation wounds. Obsolete tuberculosis of a mesenteric gland. Slight chronic pleuritis.

The dead body of a white man, 55 years of age, 170 centimeters long, well developed and fairly nourished. The head was not examined. In the right cubital space there is a purplish blotch with a brown red spot. In left cubital space is a short sutured wound. The skin of the anterior thoracic wall shows several small, scattered, dark brownish-red crusts. The anterior abdominal wall, beginning on the right side at the costal border and extending down anteriorly and along the lateral aspect as far as the upper part of the right thigh shows numerous, discrete and confluent, dark purplish, irregular areas and streaks. This condition extends across the lower part of the anterior abdominal wall to the region of the left lower quadrant and the left lateral aspect. From there it extends down to the upper part of the left thigh and to the upper part of the scrotum and along the dorsum of the penis. On the left foot there are two blister-like collections of this bloody fluid. On the big toe of the right foot there is a similar blister. Over the left tibia, groups of old, flat, brownish areas. On the right side of the anterior abdominal wall there is a linear wound 9.5 centimeters long, closed with sutures. In the region of the left lower quadrant there is a wound 10.5 centimeters long. The purplish areas are strongly marked in the region of these wounds. The subcutaneous tissues in the region of the purple areas are infiltrated with a small amount of dark purplish blood and much thin blood clot. This extends down to the muscle tissues and in places infiltrates them. In the region of the wounds the condition is well marked. The muscles of the anterior thoracic wall are pale, negative. The subcutaneous tissues are infiltrated with a considerable amount of thin pale fluid. The peritoneal cavity contains no fluid. The appendix is represented by a securely ligated stump. In the region of the stump, the peritoneal tissues are infiltrated with blood-like material. Œsophagus is negative. The stomach contains a moderate amount of opaque, brownish-red fluid and mucus. The mucosa generally is negative but at a point about 4.5 centimeters above the pylorus and along the lesser curvature, the mucosa presents a loss of substance 3.5 centimeters across. The margins are rounded, fairly smooth, rather clean-cut, but descend to a fairly smooth, grayish base. The base shows in the region of its lower left quadrant, reddish staining within which rests a small dimple-like depression, to which a small mass of dark brownish-red blood clot is weakly adherent. On cross-section, the stomach wall, in the region of the base of the ulcer, is thickened 3 to 5 millimeters. The peritoneal surface is fairly smooth; negative. No change in the retroperitoneal glands of the region is made out. The small intestine contains a moderate amount of brownish paste, but no definite bloody material. The mucosa is negative. The large intestine contains much brownish to blackish-red, fæcal material. The mucosa is negative. In places along the mesenteric insertion of the small intestine, there are small, diffuse, hæmorrhagic areas and streaks. The mesenteric glands generally are negative. There is one fibrocalcareous stony hard gland 1 centimeter across. The retroperitoneal glands generally are negative except for two glands in the region of the head of the pancreas which are slightly enlarged and one of which shows a grayish section surface mottled with small brownish-red areas. Diaphragm extends to right, fourth interspace and left fifth rib. The diaphragm of the right side of the pleural cavity anteriorly shows small hæmorrhagic areas. In the right pleural cavity are a few cubic centimeters of a thin reddish-tinged fluid; in the left, 200 cubic centimeters of a similar fluid. On the right are old adhesions in the region of the apex and upper lobe; in left, none. The lungs show no areas of consolidation. The tissue of the upper lobes is pale, spongy, and yields a small amount of thin, pale, frothy fluid. The lower lobes are pale to dark reddish. The tissues yield a moderate amount of thin, pale, reddish, frothy fluid. The pericardium is negative. The heart weighs 295 grams. The myocardium is a little lax and pale brown red. The right cavity shows slight dilatation. The heart contains a very small amount of blood. The valves are negative. The coronaries are free and negative. The foramen ovale is closed. The great vessels are negative and contain but little blood. The liver and pancreas are negative. The spleen weighs 175 grams. The capsule is smooth, the tissue plump, dark to brownish-red, bloody, and somewhat mushy. There is one small accessory spleen. The kidneys combined weighed 338 grams. The capsules of both strip and the surfaces are pale and smooth. The tissue is of good consistency, the markings are retained, and the cortex measures 5 to 6 millimeters. On section the surfaces are pale and negative. In each pelvis there is a small amount of fluid blood. The mucosa is rather generally infiltrated with a smooth, thin layer of dark, brownish-red blood clot. The ureters are free. The mucosa is negative. The bladder is distended with thin, slightly rust colored urine. The mucosa is negative. The bone marrow of the lumbar vertebræ is rather pale. Microscopic examination is negative except in two sections from the ulcer which show chronic inflammation with endarteritis. In one there is atypicality of mucosal tubules but nothing definitely carcinomatous. Retroperitoneal lymph gland shows well marked carcinoma, with some papillary adenomatous characteristics. The tissue of vertebral marrow stains poorly but it seems clear that there is carcinomatous invasion of the tissue.

Our interest in this case must center in the purpura and its etiology in spite of other in-

teresting points. Unquestionably of Knowles' first class with lowered physical condition, the primary causative factor seems to be either low-grade clot infection or iodine. The bacterial theories of purpura (2) seem to refer chiefly to focal infection, but in this patient the rectus wound might have been the portal of entry for clot infection. However, nothing was found at necropsy to suggest infection. The white count and temperature might be accounted for by infection, by absorption of the blood clot, or can be satisfactorily explained on the iodine basis. That no excreta were tested for iodine is unfortunate, for a positive test would have been absolute proof of etiology. The partial anuria after operation is suggestive. The pathological picture of the kidneys is seen in iodine cases. It is interesting to speculate whether the gastric symptoms and pathology were not exaggerated by the iodine which has a known irritating effect on mucous membranes (13, 19, and 21). The fever is perfectly consistent. In fact there is no symptom nor finding in this case inconsistent with the picture of iodine purpura of a severe type. One particularly outstanding symptom is present, and this marks an iodine purpura, viz., the presence of hæmorrhagic blebs (15). Notice also that in this case iodine has been used on a patient in whom a marked and typical iodine reaction took place early. We need not account for the relapse any more than to say that the development of the purpura and its secondary symptoms continued and gradually killed the man in spite of treatment. A corroborative fact in diagnosis is that a slight reaction took place on a very small area painted purposely with iodine for test, the necropsy protocol describing skin lesions in the region. The bacterial theory would require cultural evidence as proof. It is not necessary to introduce other theories when we know the abdomen was painted and repainted with iodine which was not wholly removed until after operation and some of which undoubtedly remained the full 2 hours. Actually we have two surgical wounds, one reopened after fresh application of the drug. Within 12 hours after the application we have a very striking reaction amounting to collapse and perfectly consistent with the picture of iodine allergy. In fact it was remarked at the time of this collapse that the so-called shock was most peculiar and atypical, and had resulted from an operation not very prone to shock. An infection unless very virulent would seemingly take a longer time to develop. I therefore class this case with those of iodine etiology and this most surely would have to be thoroughly ruled out before another etiology could be advanced.

PROGNOSIS

This seems to depend chiefly on the severity of symptoms. In all the series the death rate is strikingly high, the largest series being over 50 per cent. In any case the prognosis is most serious and death not an unlikely outcome.

TREATMENT

There is no specific therapy. Starch is the classical antidote for iodine and can be given in solution in the stomach. The usual methods of increased elimination are logical in the average case and in the purpuric type, at least, transfusion is indicated, often more than once.

CONCLUSIONS

1. A very definite iodine allergy exists, closely related to, if not the same as, iodine poisoning and iodism and identical in toxicology with its salts, the iodides, to which iodine is converted on absorption.

2. Cases of allergy closely resemble in symptoms those of poisoning and may be considered practically the same clinically, the chief difference being the amount of iodine absorbed.

3. While the condition is undoubtedly rare, precautions indicated are careful history and reasonable effort to prevent absorption, confining the action of the iodine to a local one. Early removal by alcohol is excellent. The technique of painting a postoperative wound with iodine has unfortunate possibilities. In doubtful or suspicious cases, use some other disinfectant. The obsolete use of iodine in ovarian cysts needs only mention.

4. In postoperative cases showing suggestive symptoms, test for the drug and institute appropriate treatment, depending on extent and type of symptoms.

5. A possible danger exists in the frequent use of iodine by the laity for early sterilization of open wounds. In surgery of compound fractures the full strength solution should be used with discrimination. A careful inquiry into previous reaction helps avoid fatal accidents.

6. In cases with marked idiosyncrasy, even painting the skin with iodine may cause symptoms, small amounts causing the effect.

7. Transfusion, when used, should be repeated whenever the patient is losing ground. Once may not be sufficient.

8. Iodides are commonly used in the treatment of syphilis, and in operating on this class of patient or any patient previously treated with iodide, the previous reaction to the drug should be determined, before one uses iodine again.

9. In spite of the efficiency of certain iodine salts as injections for urological X-rays, we must recognize a theoretical danger in their use.

10. In industrial plants where iodine or its fumes have been present, the workmen have sometimes shown symptoms of acute or chronic poisoning. Treatment of their injuries with iodine must be potentially dangerous.

11. I do not feel that iodine should be discarded as a disinfectant. The removal of the drug by alcohol immediately after application is desirable, and to a large extent should prevent the accidents of which the history does not forewarn us.

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THE ASSOCIATION OF FŒTAL MONSTROSITIES AND DEFORMITIES WITH PLACENTA PRÆVIA

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MUCH has been written on placenta prævia and a still greater amount has been published on fœtal monstrosities, but no one has emphasized the association of these two conditions. In not one of the well-known textbooks in English, German, or French, is mention made of the combination, except in von Winckel's *Handbuch der Geburtshuelfe* (1), where two cases are cited (Hoenck and Lomer). The *Index Medicus* from the year 1879 to the present time contains only three case reports, as indicated by the title, of the association of placenta prævia and fœtal deformities. These were reported by J. Jaworski (2), O. F. Buell (3), and J. Ritchie (4). A fourth case was found in the *Zentralblatt fuer Gynaekologie* for 1893, but this is not listed in the *Index Medicus*. This report was made by Hoenck (5), and in the discussion of the case, Lomer (6) mentioned that he had had a similar one.

Despite the paucity of indexed literature on the association of fœtal deformities with placenta prævia, it is the belief of the writer that this association is not infrequent. In the first place, of the cases in which the combination is found, not many are reported. Secondly, of those reported, exceedingly few give any clue to the condition by the title of the report. To prove this latter point, the following cases found in the course of reading current medical literature may be presented. In the January number of the *Edinburgh Medical Journal* for 1922, Ballantyne (7) reports a case of anencephalus associated with placenta prævia, in a paper bearing the caption, "Cæsarean Section: Its Indications and Technique." The same author (8), in the *Edinburgh Obstetrical Society Transactions* for 1904, mentions another case of anencephaly occurring in a patient with placenta prævia. This case was reported in a communication entitled, "The Use of Bossi's Dilator in Eight Cases of Complicated Labour," another non-informing title. Ballantyne in a personal communication says: "I can assure you that I have not very rarely found anencephalus and other monstrosities associated with placenta prævia."

L. J. J. Commiskey (9) in a paper on "Fetal and Newborn Mortality," mentions the fact that among seven cases of placenta prævia, one was born with a congenital defect of the abdominal wall. When inquiry was made as to the exact deformity present, it was learned that the author had recently died and no information concerning the fœtal defect was obtainable.

At the January (1922) meeting of the Chicago Gynecological Society, H. F. Lewis (10) reported a few fœtal monsters and among them was a case of gastroschisis associated with placenta prævia.

W. Strakosch and H. E. Anders (11) in a paper entitled, "Beitrag zur Lehre von den Akardiern: Ueber einen Holoakardius eumorphus," mention that the case which they report was associated with a placenta prævia.

M. Arnold (12) in an article on the treatment of placenta prævia mentions that two of the babies in his series were hydrocephalic.

Stenzler (13) in a recent number of the *Zentralblatt fuer Gynaekologie* in a paper entitled, "Zur Kasuistik des Schiefhalses," reports a case of torticollis associated with placenta prævia. (Torticollis is a congenital deformity not always due to external pressure effects). Katz (14) in a later number of the same journal tells of a case of placenta prævia in which the child had a number of deformities, the most conspicuous being the absence of both radii.

Finally, another case which was reported but where no clue was given by the title, is the report of an iniencephalic monster associated with placenta prævia made by Lowther (15).

In addition to the above fifteen reported cases, I have cognizance of six unreported cases, including two of my own. Abstracts of these cases are as follows:

CASE 1. (Dr. De Lee.) Mrs. F. H. S., a primipara, age 28, had a placenta prævia lateralis, and a classic cæsarean section was performed on September 28, 1912, by Dr. De Lee. The child weighed 2183 grams (4 pounds, 13 ounces), and had a marked cleft palate. This patient had a normal pregnancy 5 years later and was delivered by low forceps of a live, normal baby weighing 3345 grams (7 pounds 6 ounces).

CASE 2. (Dr. H. J. Stewart.) Mrs. R. H. P., a tertipara, age 36, had one living child, normal in every respect, age 8. A second child, born in 1918, had a spina bifida and was operated upon for this condition but with fatal results a few months after birth. At the time of birth of this child, the placenta was adherent. The last pregnancy was complicated by uterine hæmorrhages which began in the third month. Near term, profuse hæmorrhages occurred and a cæsarean section was performed on April 6, 1921, by Dr. Stewart and a live baby was delivered; but it had a hydrocephalus and a spina bifida and died a few weeks after birth. The mother's recovery was uneventful.

CASE 3. (Dr. F. H. Falls.) Mrs. J. J. M., No. 17158, a primipara, age 26, who had had a miscarriage in 1919, was admitted to the Chicago Lying-in Hospital on May 18, 1921, because of profuse uterine bleeding. The general physical examination was negative and the pelvic measurements were normal. The blood pressure was 108-60 and a catheterized specimen of urine showed a heavy precipitate of albumin, a few granular casts, pus cells and motile bacteria. A diagnosis of presentation and position could not be made. The presenting part was floating and the fœtal heart tones were regular. By rectal examination it was found that the cervix was not dilated and a boggy mass was felt in the lower uterine segment. A diagnosis of placenta prævia centralis was made and a classic cæsarean section was performed. On making the uterine incision, the fœtal viscera bulged out. The fœtus, which was about 35 weeks old, not only had an evisceration of all the abdominal contents, but also an anencephaly. In addition the following abnormalities were noted. The left eyeball was not distinguishable but seemed to be fused with a small amount of meningeal tissue present. There was a strand of skin running from the nose to the meningeal tissue and also a rudimentary right arm, seemingly arising under the sternum. On the left hand, the first two fingers were partially fused and shortened. The placenta, which was found implanted over the cervical orifice, contained a few small infarcts. The puerperium was febrile and the patient left the hospital on the sixteenth day after operation.

CASE 4. (Ward patient.) Mrs. S. U., No. 11421, age 26, an octipara, had a central placenta prævia, and a classic cæsarean section was performed by Dr. D. A. Horner on April 1, 1920. The baby had scleroderma neonatorum and died on the fourth day. The mother's recovery was uneventful.

CASE 5. (Author's first case.) Mrs. C. W. K., No. 20409, a primipara, age 22, was brought to the Chicago Lying-in Hospital in labor on December 17, 1921, by her physician, because upon making a vaginal examination at the patient's home, he found a prolapsed hand. On admission, the temperature was 100° and the pulse rate 100. The membranes had ruptured 2 days previously and the fœtal heart tones were regular. Abdominal examination was unsatisfactory, but rectally the prolapsed hand was felt and the cervix was found to be dilated 3 to 4 centimeters. Because the membranes had ruptured, the cervix only partially dilated, a hand prolapsed and pains weak, I decided to insert a colpeurynter into the uterus. On making a vaginal examination previous to the insertion of the bag, the right hand was felt and alongside of it, an acranial head. A ten centimeter bag was inserted and when about half full of lysol solution, there was a sudden gush of bright red blood, approximately 300 cubic centimeters being expelled. The bag was quickly filled and traction made. On examination, a portion of the placenta was found resting between the colpeurynter and the right side of the cervix. We were dealing with a placenta prævia partialis. A one and a half pound weight was attached to the bag and the pains gradually became stronger. The fœtal heart tones remained regular and there was no bleeding. Despite strong contractions, dilatation of the cervix was slow, so morphia and scopolomine were given hypodermically. At 4.30 p.m. December 18, exactly 24 hours after its insertion, the bag was expelled spontaneously. Rectal examination revealed the prolapsed arm and the acranial head. The cervix was dilated 6 centimeters[1] and since there was no bleeding, labor was permitted to progress. At 6.10 p.m., the fœtal heart tones could not be heard, and at 6.30 p.m., the hand was visible at the vulva. The arm was liberated, a vulsellum was placed on the fœtal head, forceps were applied, and the head very easily delivered. The rest of the child followed readily. The placenta was removed manually and found to contain many succenturiate lobes. One portion of the placenta, measuring approximately 7 by 5 by 3 centimeters, was very dark and boggy. This was the portion which had projected from the cervical orifice after the insertion of the bag. The fœtus, in addition to being an anencephalus, had a marked pigeon-breast and a deformed right wrist. The latter, however, on X-ray examination, appeared normal. The patient refused to remain in bed after the third day postpartum and left the hospital on the fifth day feeling perfectly well.

[1] Three ounces of fluid had been permitted to escape because of weak pains.

CASE 6. (Author's second case.) Mrs. S. McC., No. 24997, age 30, a quintipara, with a negative past history, was admitted to the Chicago Lying-in Hospital on September 29, 1922, because of a severe uterine hæmorrhage. She was in the seventh month of pregnancy. On admission rectal examination revealed a double footling presentation in the presence of a partial placenta prævia. About 600 grams of clotted blood were removed from the vagina and slings were placed on both feet of the fœtus. A weight was attached to the slings and after 4¼ hours the fœtus was expelled spontaneously. There was no bleeding following this and the placenta was expressed from the uterus after it had separated. The portion of placenta which had been felt per rectum and per vaginam, was covered with an old blood clot. The fœtus, which weighed 920 grams, was an anencephalic monster. The patient made an uninterrupted recovery and went home on the tenth day. A Wassermann test made during pregnancy had been negative.

In considering the etiology of monsters, we must, according to Mall (16), distinguish two groups: First, the monsters in which the proper conditions to produce them are already in the germ (and are therefore inherited), and secondly those due to certain external influences which act upon the egg after it is fertilized. Mall believes that defective development is due to "faulty implantation." He says: "All our experience in teratology, if read aright, indicates that the normal ovum, getting into a diseased uterus, did not implant itself well, and the consequent impairment of nutrition produced a monstrous embryo. This hypothesis explains fully the presence of so many pathological embryos in multiple abortions and the apparent germinal origin of merosomatous terata like spina bifida and anencephaly." He also says: "They (ova) could not attach themselves successfully to the diseased uterus and, because of malnutrition or of poisons which are thrown out from the inflamed surfaces, the chorion becomes pathological and the embryo deformed. . . . Abortion usually follows as a result of serious lesions in the chorion as well as in the environment. Should the alterations in the embryo and in the chorion be very slight and the condition of the uterine mucous membrane, which may be expressed by the term inflammatory, be overcome, the pregnancy in all probability would go to term and end in the birth of a monster or an infant presenting a well recognized malformation."

In a large number of the placenta prævia cases a history of some antecedent disturbance in the uterine mucosa may be elicited. In nearly all cases of placenta prævia, there is "obtained a history of abortion, of manual removal of the placenta in previous labors, of recurrent placenta prævia and other evidence of a diseased endometrium, and the findings on the placenta often confirm the endometritis as the predisposing factor." (De Lee, 17.)

Von Winckel (18) collected 87 fœtus from tubal pregnancies which continued to live and were removed alive from the abdominal cavity, and he found that 57 of them were much deformed and 12 were markedly monstrous. The placenta was usually deformed, sometimes multiple, broad and thin or short and thick and often very hæmorrhagic. Mall (19), commenting on this says: "For the 12 cases which were markedly monstrous, we must hold the hæmorrhagic placenta responsible, which could be included under what I have termed faulty implantation."

Stockard (20) agrees with Mall that faulty environment stands in causal relationship to fœtal monsters, but from his experiments he believes the modus operandi to be essentially an inadequate oxygen supply. Stockard says: "In view of experimental results, it becomes evident that the normal development of the vertebrate embryo depends acutely upon the stability of certain factors in the environment. Changes in the conditions of moisture, temperature, and oxygen supply are the most frequent causes of embryonic death as well as monstrous development." The primary cause of all abnormal developments is reduced by Stockard to a single factor, namely developmental inhibition or arrest. The type of deformity that results depends solely upon the exact moment when the interruption occurs. Stockard's experiments were confined mostly to fishes, but according to Arey (21), these concepts "should apply equally well to human abnormalities and twinning provided the ovum is subject to delay before implantation and to arrest afterward. There is ample

evidence for both conditions in the tube." Also, "there is a demonstrable frequency of faulty implantation in tubal pregnancies. Mall failed to find a typical decidua here and its functions in checking hæmorrhage by forming a dam between the tips of the villi and the eroded mucosa is foregone. Numerous hæmorrhages result. Checks, permanent or temporary, while the chorion is struggling to overcome natural deficiencies in its nidus are sufficient to account for . . . the observed double frequency of malformations in these specimens over the uterine group."

In placenta prævia, conditions may be likened somewhat to those in tubal pregnancy. The decidual reaction in the lower uterine segment, while much more efficient than in tubal pregnancy, is not as complete as in corporal pregnancy. The chorionic villi in the lower uterine segment may invade the uterine muscle as do the villi in tubal pregnancy. Nutritional disturbances (Mall) or disturbances in the oxygen supply (Stockard) may, therefore, take place in cases of placenta prævia just as well as in tubal pregnancy and produce monsters, although not so frequently.

An explanation for the occurrence of fœtal monstrosities in cases of placenta prævia may be as follows: For some reason, the ovum is implanted in the lower uterine segment. When this happens, there is a faulty relation between the placenta and the fœtus. In cases of faulty relation between placenta and fœtus there are arrests of development and where arrests are present, monsters occur.

Twelve of the twenty-one monstrosities mentioned in this paper had cranial and intracranial defects. An explanation for this frequency may be found in Mall's statement: "When we consider the whole ovum, it is the embryo itself which is first destroyed, while within the embryo, the central nervous system or the heart is the portion which is first affected" (22). A case of missed abortion which I (23) studied histologically, is in accord with Mall's assertion.

Of what clinical importance is the association of fœtal deformities with placenta prævia? First, dangerous and even fatal bleeding may result from placenta prævia associated with such a deformity as hydrocephalus, when delivery is attempted through the vagina. Hoenck's patient in whom this association was present, died from hæmorrhage while attempts were being made to deliver the head. Secondly, obstetricians are resorting to cæsarean section more and more in the treatment of placenta prævia, especially in a primipara or in a multipara with an undilated cervix.

The abdominal route as a means of delivery in placenta prævia is selected chiefly in the interest of the child. Picture the consternation of the operator when he delivers a fœtal monstrosity, especially if he had urgently advised cæsarean section to the parents who were anxious for a living child. If the association of fœtal monsters with placenta prævia were more common than it is, cæsarean section as a means of treating placenta prævia would lose much of its deserved popularity.

How is one to tell before delivery whether a fœtal monster or deformity is present? Usually it is a very difficult matter. The fœtal heart tones are present in practically every case where cæsarean section is considered, but a correct diagnosis of presentation and position is not easily made. First it is not considered safe to make a vaginal examination in a case of placenta prævia where an abdominal operation is contemplated. Even a rectal examination is not without danger, especially that of starting a hæmorrhage. Because of these facts and because even in the cases where examinations are made, great care is exercised and a very thorough examination is not usually made, it is not often possible to detect any abnormality in the child, even if one is present. It is conceivable that anencephalus or hydrocephalus may be diagnosed, but thus far, there is no case on record known to the author, other than his own (Case 5), in which the diagnosis of anencephaly associated with placenta prævia was made before delivery. It is therefore advised that in cases of placenta prævia where the occiput is not definitely felt or where the head feels unusually large, an X-ray picture be taken. This will usually reveal the deformed skull. It is conceivable that with improved technique, an X-ray plate may perhaps show a deformed spinal column or spina bifida.

Other abnormalities, such as eventration of the viscera and defects in the soft tissues are practically unrecognizable under present conditions. However, since more than half of the above-mentioned fœtus had skull deformities, they would most likely have been detected in roentgen-ray pictures. A number of cases of hydrocephaly and anencephaly has come under my observation where the diagnoses were made by X-ray pictures before delivery.

One may go a step farther and take an X-ray picture in all cases of placenta prævia where a cæsarean section is contemplated. It might be added parenthetically, that in all cases where abdominal delivery is planned, regardless of the indication, and where a definite occiput is not felt or where the head appears unusually large, it might be advisable to have an X-ray picture taken before operation, a point emphasized in De Lee's *Obstetrics*.

SUMMARY

An attempt has been made to prove that fœtal monstrosities and deformities not infrequently occur in cases of placenta prævia. To fifteen cases found in the literature, the author has added six more. This by no means represents the total number of cases to be found in the literature, for most of the cases have been hidden in articles the titles of which give no clue to the subject here discussed. Many case records of teratological births will undoubtedly reveal an associated placenta prævia, but the latter is not named in the title of the communication.

It is the belief of the author that the monsters associated with placenta prævia are due to the faulty relation between the placenta and the fœtus which gives rise to arrests in development.

Since fœtal monsters not infrequently are associated with placenta prævia, it is advisable in cases of placenta prævia where cæsarean section is contemplated, to try to ascertain by physical examination and especially by X-ray pictures, whether the fœtus has a deformity.

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Note.—On January 14, 1923, we had another patient at the Chicago Lying-In Hospital who had placenta prævia partialis and who gave birth to an anencephalic monster (Mrs. B. O., No. 26695).

IMMEDIATE VERSUS DELAYED OPERATION IN CASES OF COLLAPSE FOLLOWING RUPTURED ECTOPIC PREGNANCY

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IT is agreed that in cases of shock from hæmorrhage due to a ruptured ectopic pregnancy, pain should be relieved, examination avoided, and external heat applied, but it is a question whether operation should be done at once or deferred. Fluids are generally withheld unless operation is planned immediately. An ice bag to the abdomen should not be used, as cold increases the shock.

The point most in dispute is the time of operation, and it is the object of this paper to present clinical evidence afforded by 184 cases, which were in critical condition. One hundred and thirteen of these were operated upon immediately and 71 were treated expectantly.

There would be no question as to the time of operation if all the cases improved under palliative measures, for surely it is preferable to operate when the patient is in comparatively good condition, but unfortunately a fair percentage of these serious cases die when left to themselves or when treated expectantly. This statement has been denied. Robb[1] reported twenty cases of ectopic gestation of whom five were in poor condition and asserted that all patients in collapse would improve under care. Simpson[2] reported one hundred cases of ectopic pregnancy and stated that he had not seen a death from hæmorrhage. Many other writers, however, report one or more deaths from hæmorrhage in their experiences. The author well recalls two non-operative deaths reported by Barber to the Society of the Alumni of the Woman's Hospital and recently was much impressed by a death from hæmorrhage of a private case. Stimulated by that death I have sought evidence as to the frequency of this calamity and have reviewed the histories of several hundred patients in three hospitals that receive many of these serious cases through their public ambulance services. Drs. F. C. Holden of Bellevue Hospital, I. S. Haynes of the Harlem Hospital and E. H. Pool of the Second Surgical Division, New York Hospital, kindly gave me the privilege of studying their case records. Of 824 cases of ectopic pregnancy, 187 were in various degrees of collapse. One hundred and thirteen of these urgent cases were operated upon immediately in these three institutions. Of the remaining 74 cases, 10 died from hæmorrhage, unoperated upon. Three of the ten, through errors in diagnosis, did not receive regular palliative treatment. Omitting them we see that of 71 critical cases treated expectantly, seven (10 per cent) died from hæmorrhage.

In the Medical Examiner's Office, the writer was furnished with complete records of 21 deaths from hæmorrhage in unoperated upon cases of ruptured ectopic pregnancy during the 4 years from 1918 to 1921 inclusive. Eight of these deaths occurred at home and 13 in hospitals.

The files of the Board of Health show that in 1921 in the Borough of Manhattan there were 20 deaths from ectopic gestation and that 5 of the 20 were due to hæmorrhage in ruptured cases—unoperated upon.

A brief account of the deaths in the unoperated upon cases is given in the table.

Death from hæmorrhage, therefore, does occur and with sufficient frequency to warrant the attempt of the immediate operation to forestall it, provided the attendant mortality is favorable.

Let us now look at the results in the two series of cases, i.e., 113 operated upon immediately and 71 with expectant treatment and deferred operation. In the series of 113 cases with immediate operation there were 10 deaths (8.8 per cent). Five deaths were due to postoperative shock, one to peritonitis, one to intestinal obstruction, two to pneumonia and one to cerebral embolism and pneumonia combined. In the second series of 71 cases, with expectant treatment and deferred

[1] Am. J. Obst., lvi, 6.
[2] Surg., Gynec. & Obst., 1907, v, 503.

DEATHS FROM HÆMORRHAGE IN UNOPERATED UPON CASES OF RUPTURED ECTOPIC GESTATION

Case No.	Place	Diagnosis	Time (Rupture to Death)	Autopsy
1	Home	Acute indigestion	9 hours	More than 2 quarts of fluid and clotted blood in peritoneal cavity. Left tube ruptured near cornua. Opening ½ inch long.
2	Hosp.	Ruptured ectopic	4 hours	1500 cubic centimeters of fluid blood and large quantity of blood clots in peritoneal cavity. Site of rupture not stated.
3	Hosp.	Not certain	32 hours—½ hour after admission.	Peritoneal cavity filled with fluid and clotted blood. Rupture at cornua—opening 1 inch long.
4	Home	Unattended	1 hour	No autopsy—history typical—pregnant 3 months—vaginal bleeding 2 months. Body exsanguinated.
5	Hosp.	Appendicitis	48 hours	Rupture at middle of right tube. Opening ¼ inch long.
6	Hosp.	Not certain	48 hours after rupture. 1½ hours after admission.	More than 2 quarts of fluid and clotted blood in peritoneal cavity. Right tube ruptured at middle, 2 months gestation, sac intact.
7	Hosp.	Surgical abdomen	14 hours after rupture; 12 hours after admission.	Peritoneal cavity filled with fluid and clotted blood. Perforation ½ inch long at right cornua.
8	Home	Gastritis and acute indigestion.	24 hours	Left tube ruptured at middle.
9	Home	Not attended	4 hours	Right tube ruptured near uterus. Opening ⅜ inch long.
10	Hosp.	Ruptured ectopic	2¾ hours after admission.	Rupture of 2 months gestation sac in left tube. Site not stated.
11	Hosp.	Acute general peritonitis	48 hours	Peritoneal cavity filled with blood. Right tube ruptured in outer half.
12	Hosp.	Ruptured ectopic	6 hours after rupture, 3 hours after admission.	No autopsy.
13	Home	Not made	Not stated.	2500 cubic centimeters of blood in peritoneal cavity. Rupture ½ inch long at middle of right tube.
14	Home	Not made	3 hours	No autopsy—typical history. Body exsanguinated.
15	Hosp.	Ruptured ectopic	55 minutes after admission.	Two quarts of blood in peritoneal cavity. Perforation ¼ inch long at middle of tube. Side not stated.
16	Hosp.	Not certain	6 hours after admission.	Large quantity of blood in abdomen. Right tube ruptured in middle third.
17	Home	Not attended. Had been in hospital 3 days and had gone home against advice.	Not known.	Peritoneal cavity filled with clotted blood. Rupture 3 inches long across site of an interstitial pregnancy. Fœtus 16 centimeters long, lay in cavity in left horn.
18	Home	Appendicitis	24 hours.	Rupture near outer extremity of left tube.
19	Hosp.	Internal bleeding	1 hour 35 minutes after admission.	Abdomen filled with fluid and clotted blood. Right tube ruptured at middle opening, the size of a goose quill.
20	Hosp.	Shock and collapse	24 hours after rupture, ½ hour after admission.	Abdomen filled with clotted blood. Right tube ruptured and contained two-month embryo. Site of rupture not stated.
21	Hosp.	Not stated	Not stated.	Autopsy showed that death was due to ruptured ectopic pregnancy. No details given.
22	Hosp.	Ruptured ectopic	40 hours after admission.	Rupture at middle of left tube.
23	Hosp.	Collapse	8 hours after admission.	Two litres of blood in abdomen. Rupture at middle of left tube.
24	Hosp.	Ruptured ectopic	12 hours after admission.	Details of autopsy not learned.
25	Hosp.	Ruptured ectopic	2 hours after admission.	Autopsy showed ruptured interstitial pregnancy.
26	Hosp.	Collapse	45 minutes after admission.	Details of autopsy not learned.
27	Hosp.	History of ectopic	20 minutes after rupture in ward.	Details of autopsy not learned.
28	Hosp.	Fibroids and acute pyelitis.	45 minutes after rupture in ward.	Details of autopsy not learned.
29	Hosp.	Unruptured ectopic	3 hours after vaginal examination in hospital.	No autopsy.

operation, there were 12 deaths (17 per cent). Four deaths due to postoperative shock, 7 to hæmorrhage unoperated upon and one to cardiac dilatation. Practically, then, the better results were obtained from the immediate operation in the three hospitals considered.

In recent years both methods of treatment have improved and those who advocate either may be loath to accept the results in cases that date back 10 years or more as do some cited above. In the service of Dr. E. H. Pool at the New York Hospital, cases showing signs of hæmorrhage have all been operated upon as soon as possible after admission. It is felt that those apparently in shock may be suffering from hæmorrhage. The two conditions cannot altogether be differentiated. A slow weak pulse suggests syncope. A rapid weak pulse indicates hæmorrhage. Warmth and fluids are indicated for each condition but hæmorrhage should be arrested. Therefore, measures to combat shock,—morphine and heat—are immediately inaugurated on admission and intravenous fluid administered as operation is begun. Thus early operation with arrest of hæmorrhage is enforced and it is rendered safe by the administration of fluids. There have been 21 critical cases in the last 6 years with one death on the fourth day postoperative from cerebral embolism and pneumonia.

Theoretically it seems to the writer that the vital thing needed by these cases in collapse from hæmorrhage is the addition intravenously of warm circulating medium such as saline,

gum glucose solution, or blood. Fluids cannot be given, however, unless operation is planned to follow soon or done coincidently. Infusion and transfusion give the immediate operation a great advantage. They enable one to gain some control of the situation. A small amount of fluid will often revive almost immediately a patient *in extremis* and make an operation possible. With the vessels tied one may give gum glucose solution or blood as needed. Whereas, if an immediate operation is not planned, fluids must not be added to the circulation and the slower method of the patient taking up her own serum must be relied upon. If she is cold and pulseless the chance of her doing this even slowly is not always good. Those cases that die in the wards within an hour or so would seem to have a better chance if they were infused and operated upon immediately and transfused later if necessary.

SUMMARY

1. Deaths from hæmorrhage are not uncommon.

Of 824 cases of ectopic pregnancy, 187 were prostrated from hæmorrhage.

There were 10 deaths from hæmorrhage in 74 of these cases. The remaining 113 were operated upon immediately.

The Medical Examiner's office has recorded 21 deaths from hæmorrhages in the last 4 years.

The records of the Board of Health show that in 1921 there were 20 deaths from ectopic gestation in the Borough of Manhattan and that 5 of the 20 died from hæmorrhage unoperated upon.

2. The immediate operation in the serious cases gives the better result.

Mortality in 113 consecutive cases of collapse operated upon immediately in three institutions was 8.8 per cent.

Mortality in 71 consecutive cases of collapse with expectant treatment and deferred operation in two institutions was 17 per cent.

In a more recent series of 21 consecutive cases of collapse in one institution operated upon immediately, there was one death.

A STUDY OF THE CASES OF CARCINOMA MAMMÆ OPERATED UPON BY MYSELF AND THE END-RESULTS OBTAINED IN THEM

By J. E. SADLIER, M.D., F.A.C.S., Poughkeepsie, New York

IN this paper it is my purpose to bring to your attention a brief study of all the cases of carcinoma of the breast operated upon by me during the past 20 years; that is, from January 1, 1900, to January 1, 1921.

A very determined effort has been made to trace all cases. Fortunately our records were rather definite as to naming some relative and this helped materially in finding out the end-results in the case of those who died. Hence, I am pleased to report that each one of the entire series of 70 cases operated upon during this twenty-year period has been definitely traced and the end-result determined. In this particular the record is somewhat unusual.

In our case histories we have been most anxious to determine the length of time the growth has existed prior to operation and while in a few cases we have definite information, yet in the main the question is most indeterminate, as the patient usually discovers the tumor after it has been in existence for many months. Therefore, what knowledge we have on this subject is of no material value.

All operations in this series have been of the radical type and while we have varied from time to time with reference to plan of skin incision, method of approach to axillæ, the particular type of plastic closure, etc., we have nevertheless always kept steadfastly in mind the necessity for removing all possible cancer-bearing tissue, as was so ably brought to our attention during the last decade of the nineteenth century by Halsted, Meyer, and others, and still later by the splendid studies of Handley. Hence, the pectoral muscles with the exception of the clavicular portion of the major have been sacrificed, the axillæ carefully dissected and, where it was involved or suspected of being involved, the supraclavicular region was also cleared of all glandular and fatty tissue. Vast areas have had to be skin-grafted or plastic operations performed to cover, where by reason of the extensive character of the neoplasm it has seemed best to sacrifice much skin. In fact, no incomplete operations were done. In some cases it was necessary to perform secondary operations for local recurrence or for supraclavicular involvement which had not been suspected at time of primary operation. Thus, we have all cases in this group upon the same basis in so far as completeness of operation is concerned.

During this period of 20 years I can recall no patient who was refused operation; in fact, all patients who presented themselves were operated upon and given a chance, and though I am convinced that in certain cases this was a mistake and a mutilating operation was performed which in no way stemmed the course of the disease, still, in other cases that seemed quite as advanced, we have patients living years afterward and free from malignant disease. Human judgment and laboratory studies of removed specimens seem inadequate to determine definitely what the outcome is going to be in any operated case. I do believe that in the future proper X-ray study of the mediastinum, bones, etc., prior to operation will cause us to eliminate some cases that otherwise we would operate upon, and in my recent work I have adopted this procedure.

All pathological specimens of this series were given careful laboratory study. In most cases frozen section at time of operation was practiced though it was always confirmed later by more deliberate and careful pathological examination. Yet, I find that in a few of our early cases we have failed to record the exact type of malignancy. These we have placed in a separate table.

During the period involved in this series of malignant cases there were also operated upon 31 cases of benign tumor of the breast, including one case of tuberculosis. These were naturally less extensive operations, excisions, simple amputations, subcutaneous amputations, etc. The relative proportion of benign

TABLE I.—TYPE OF CANCER

Total Number of Cases of Cancer of the Breast, 70

	Cases	Percentage
Scirrhus	34	48.5
Medullary	17	24.2
Type unknown	7	10.
Adenocarcinoma	6	8.5
Duct	3	4.2
Sarcoma	2	2.8
Cyst carcinoma	1	1.4

TABLE I, a.—AGE

	Cases	Percentage
21 to 30	1	1.4
31 to 40	8	11.4
41 to 50	18	25.7
51 to 60	24	34.2
61 to 70	11	15.7
71 to 80	7	10.
Over 80	1	1.4

to malignant tumors, 1 to 2¼, is somewhat greater in favor of the benign than is usually considered to be correct. These benign cases have been traced and all are found to be living and no case has developed malignant disease, which speaks forcibly for the early operative treatment of benign tumors in the mammary gland. Whereas, we have among the series of 70 malignant cases, patients who were known to have had simple tumors of the breast for many years which later became malignant and were subjected to radical operation with only the usual modest percentage of ultimate cure. For example:

Mrs. H. M. G., age 53. Marked family history of cancer. Mother of six children. No difficulty with breasts during lactation.

About three years prior to operation patient noticed a small lump in right breast. It was not painful and was examined by a prominent surgeon who pronounced it a benign tumor and counselled against removal although a certain amount of X-ray treatment was prescribed without benefit. It was later punctured by the same surgeon under the suspicion that it might be a cyst. During the 3 years that it was being watched and treated from the non-surgical standpoint it gradually increased in size. Finally, when there developed within it sharp stinging pains its removal was sought. It was freely movable and there was no palpable axillary involvement. Under suspicion that there was danger of it ultimately becoming malignant an operation was decided upon. A frozen section made at time of removal proved it to contain a carcinomatous area. A radical operation was performed in March, 1907. Patient is still living, without recurrence.

No effort has been made in this study to separate the cases with glandular involvement from those with no such palpable metastases. We feel that such distinction, without referring to the certainty that goes with mediastinal or remote glands, is of value from the standpoint of prognosis. According to Halsted, cases without glandular involvement have about a 70 per cent chance of cure, whereas those with such involvement have but 25 per cent prospect of ultimate recovery. Recent statistics received from Sistrunk of the Mayo Clinic (personal communication) show that 64 per cent of cases with no glandular involvement are alive without recurrence from 5 to 8 years after operation, whereas only 19 per cent of those with glandular involvement are alive and free from recurrence for the same period. These figures are convincing and leave no argument as to the necessity for early radical operation. It is a settled question that cases with glandular involvement have a decreased chance of cure, but as malignant breasts have an operability of about 100 per cent—at least, it was so determined in this series—we have to take them as they present themselves and do the best we can for them.

Therefore, for the purpose of this study and in order to determine the final end-result in a series taken in the condition in which they present themselves it is best not to attempt such differentiation, especially when we consider that in many cases such determination can be arrived at only after operation and pathological study, and even then it is not absolute unless a vast number of sections have been made. Hence, we are interested in knowing and publishing the end-results from cases taken as they came, regardless of the stage of disease, thereby endeavoring to bring to public notice statistics which will be convincing that operative procedure has a definite life-saving value as based upon present condition of public knowledge and methods of surgery.

I am pleased to report that in this series, there was no operative mortality, all patients having left the hospital alive.

I have definitely determined that of the 70 cases of the series which includes two cases of sarcoma, we have alive and free from recurrence 23 cases, representing 32.85 per cent of the total number operated upon (see Tables IV and IV, a).

TABLE II.—DEATHS

Number of Deaths in the Series from Cancer, 36, or 51.4 per cent

	Cases	Per cent of Deaths	Per cent of Type
Scirrhus	16	45.6	47.0
Medullary	11	31.4	64.7
Type unknown	5	13.8	71.4
Adenocarcinoma	1	2.8	16.6
Duct	2	5.6	66.6
Sarcoma	1	2.8	50.0

TABLE II, a.—LENGTH OF TIME AFTER OPERATION PATIENTS DIED

	Cases
One year after operation	20
Two years after operation	8
Three years after operation	4
Four years after operation	1
Six years after operation	1
Seven years after operation	1
Eight years after operation	1

There have died from other conditions *without* recurrence of carcinoma and with an interval of from 1 to 10 years of perfect health conditions 10 patients, representing 14.2 per cent of the whole series (see Table III).

These added to 32.85 per cent living without recurrence a total of 47.05 per cent who are either living without recurrence or dead of other conditions without recurrence.

I appreciate the fact that there are 5 cases operated upon within the past 3 years included in this series of cases without recurrence that are still in the doubtful stage. But as this paper has to do with our result after a 20-year period rather than some particular period after operation I feel that it is correct to incorporate them. Nevertheless, let us consider the series from the standpoint of those living 3 years from time of operation and free from recurrence (see Table IV, b).

Here we find that 26, or 37.1 per cent of the series, are alive, or dead of other conditions, 3 years or more after operation and without recurrence of cancer.

As I study my cases and the tables here shown I am impressed with the well-known thought that cancer varies in grade of malignancy and virulence much as other disease does. As representing this point as to the extremes of malignancy, I would briefly describe the following cases:

Miss E. T.. age 32. This case, classified under Table II, a, is distinctive of the type of cancer of extreme malignancy, dying within 1 year following date of operation, and perhaps a type which would be quite as well off with a simple amputation as no operation seems to be of any lasting benefit.

TABLE III.—DYING FROM OTHER CAUSES, WITHOUT RECURRENCE

Number of Years after Operation	Cases	Types
Under 1 year	1	Scirrhus
After 1 year, under 2 years	1	Scirrhus
After 2 years, under 3 years	3	Scirrhus Duct Cyst
After 3 years, under 4 years	2	Scirrhus Type unknown
After 5 years, under 6 years	1	Medullary
After 10 years	2	Scirrhus Adeno
Total, with percentage of the series	10	14.2 per cent

Previous to September 7, 1902, patient had no knowledge whatsoever of the existence of any tumor. Upon said date she discovered a distinct hardness of the right breast and within 3 weeks thereafter entered the hospital for operation.

A diagnosis of extensive cancer of the breast and axillary glands was established. A radical operation was performed with resulting uneventful recovery. Type of cancer: duct carcinoma. Within a few weeks there was extensive involvement in the region operated upon and throughout the shoulder. Patient died within 6 months of both external and internal cancer.

The rapidity and virulence of the growth leads one to suppose that the very act of operation spread the malignant process more rapidly than otherwise would have been the case.

Mrs. J. W., age 65. This case represents the cancer which has been in existence for a long period of time, and one doubts the wisdom of operative procedure, yet later events prove that occasionally such a case is cured, the patient living for many years finally to die of some other trouble.

For 3 years this woman had a painless but gradually enlarging tumor, of hard consistency, developing in the right breast. She had repeatedly been advised to have it operated upon and it was only after it had ulcerated and was extremely foul-smelling, so much so as to make it rather obnoxious to the inmates of the Old Ladies' Home in which she resided, that she finally consented to enter the hospital for operation. At this time the glands in the axilla showed marked involvement and the patient was emaciated to a great extent. At the time of her operation it was considered that a cure could hardly be looked for. Nevertheless, a radical operation was performed. The patient made an uneventful recovery, living 10 years without recurrence and finally passed away as a result of pneumonia.

TABLE IV.—NUMBER LIVING WITHOUT RECURRENCE, 23, OR 32.85 PER CENT OF SERIES

Type	Cases	Per cent of Living	Per cent of Type
Scirrhus	12	52.1	35.2
Medullary	5	21.7	29.4
Adeno	4	17.3	66.6
Sarcoma	1	4.2	50.
Unknown type	1	4.2	14.2

TABLE IV, a.—LIVING WITHOUT RECURRENCE, WITH NUMBER OF YEARS

	Cases
Over 1 year	3
Over 2 years	2
Over 3 years	2
Over 4 years	4
Over 5 years	1
Over 6 years	1
Over 7 years	2
Over 8 years	1
Over 9 years	1
Over 10 years	1
Over 12 years	1
Over 14 years	2
Over 15 years	2
	23
Living with recurrence after 3 years	1

TABLE IV, b.

	Cases	Per cent of Series
Living more than 3 years after operation	18	25.7
Died of other causes, after 3 years, without recurrence	8	11.4
	Cases	Percentage
Total number cured, based on 3-year period	26	37.1

TABLE IV, c.

	Cases	Per cent of Series
Living more than 5 years after operation	14	20.
Died of other causes, after 5 years, without recurrence	3	4.2
	Cases	Percentage
Total number cured, based on 5-year period	17	24.28

Thus recognizing that the degree of virulence of the disease is one of the greatest factors in determining the result, may it not be possible for us to make a more intensive study of each case prior to operation and thereby anticipate some of our unfortunate results? For instance, given a case in a relatively young person with rapid development of growth and early involvement of glands, would it not be wise to assure ourselves prior to operation that there is no mediastinal or bone involvement and inquire most carefully as to there being any cough, dyspnœa or evidence of involvement of the chest, carefully examine the liver and investigate the patient from all standpoints? The fact that 20 or 28.5 per cent of this series died within 1 year from the time of operation inclines one to consider that among the number there must have been some who were hopeless when operated upon and should not have been subjected to it or at least should not have had the radical mutilating operation.

In contradistinction to the above are the cases occurring in older people where the disease has been in existence for from 1 to 3 or 4 years and in some there is supraclavicular as well as axillary glandular involvement but no evidence of intrathoric or distant metastases. Here we have in spite of the long existence of the growth a fair prospect of ultimate success. My experience coincides with that of Pilcher, with respect to the possible curability by operation of cases where there is supraclavicular involvement and it is high time that we throw into the discard the old idea that such involvement renders a patient hopeless. Case 14 of this series, operated upon March, 1906, had extensive supraclavicular involvement and is now in perfect health, 15 years from date of operation. Another, with extensive involvement above the clavicle, lived for 6 years and died of other conditions, and a third lived for 10 years without recurrence of cancer.

In Table II, a, we notice that 32 of the 36 deaths from cancer occurred within the 3-year period. This adds strength to the argument that patients are relatively safe who have passed the 3 years after operation without recurrence and especially is this so when we analyze some of the so-called late recurrences, for frequently we are apt to find that we are not dealing with a metastasis but rather with a definitely new development, as evidenced by the different type of cell.

The following history is instructive from this standpoint.

Mrs. J. T., age 60, operated upon in June, 1904, for a carcinoma of the left breast, which had been in existence so far as the patient knew for only 1 month.

A complete radical operation was performed which necessitated extensive skin grafting. An examination of the specimen showed it to be medullary carcinoma. The patient made a good recovery. However, a few months later it was necessary to do

an extensive operation to remove carcinomatous glands which had developed in the supraclavicular region. From this she also made a nice recovery and remained perfectly well and free from cancer for 6 years. Then she developed suspicious symptoms in the bladder, and a cystoscopic examination disclosed the fact that there was a malignant area. So, in June, 1910, 6 years after her breast operation, a transperitoneal section of her bladder was performed and the diseased area removed. Examination of specimen proved it to be carcinoma which had developed upon a pre-existing papilloma.

She recovered nicely from the operation and remained free from any recurrence in the bladder but later developed carcinoma of the liver and died.

Here we have a case where there is an interval of 6 years between the removal of the breast and the onset of the bladder growth. The cell type was different in each case. Hence, the growth in the bladder can hardly be considered metastatic from the carcinoma of the breast.

Table I, relating to type of cancer, shows about the customary proportion of medullary to scirrhus, 24.2 per cent of former and 48.5 per cent of the latter, but the number of adenocarcinomata is quite below the average, being only 8.5 per cent. The only noteworthy thing with reference to the age of the patients in this series is that 9, or 12.8 per cent, were under 40 years of age. Eight of them are dead of recurrence of cancer and the ninth one died some 10 years after her operation of other conditions but without recurrence. Hence, if we classify this one case as cured we have about 11 per cent of recovery for this group.

Of those living without recurrence, the adenocarcinoma shows 66 per cent of ultimate recovery which represents a high percentage of cure and corresponds with the usual well known favorable outcome in this type of cancer.

Scirrhus cancer has to its credit 35.2 per cent without recurrence and as might be expected the medullary type is least favorable with only 29.4 per cent remaining alive and free from recurrence.

These figures are so nearly in accord with those of other investigators that one is impressed with the definite exactness with which the percentage of cured cases can be determined from the type of cancer.

Furthermore, one recognizes that these figures demonstrate that in a given series, a certain proportion can be cured by radical surgical operation and this percentage of cure is probably as great as operative procedure will obtain, although moderate advantage and increased curability may result from the more general use of X-ray and radium as adjuncts to operation. Yet, the great loss of life that appertains in this disease, in spite of the most perfected treatment, will be lessened only when, through education, the people have learned to know the great advantage of early surgical treatment of the radical type and present themselves without delay. At the present time many patients are so far advanced that the prognosis is grave. Those representing the degree of extreme virulence and those in earlier life will have a very modest percentage of cure, even when, through general education, the public is impressed by the necessity of early radical operation.

OVARIAN PREGNANCY

By F. L. GOOD, M.D., and T. K. RICHARDS, M.D., Boston

CASES of ovarian pregnancy are comparatively rare. This is particularly true of examples of pregnancy which have gone to full term. On this account it seems worth while to put the following case on record.

June 22, 1918. (No. 373868.) The patient, a married Italian woman 32 years old, entered The Boston City Hospital complaining of pain in the lower abdomen and loins. The temperature, pulse and blood pressure were normal. The urine showed the slightest possible trace of albumin. Owing to the patient's inability to speak English, no family or past history could be obtained, except that she had had one previous full-term pregnancy.

Present illness. Beginning 13 months ago the patient had amenorrhœa which persisted for 8 months. For the last 5 months menstrual periods had been regular. She complains of more or less constant pain in lower abdomen and loins.

Fig. 1. Full term ovarian pregnancy within the fœtal sac.

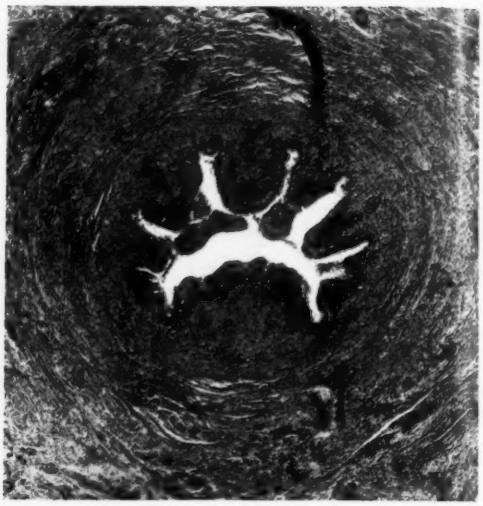

Fig. 2. Section through wall of fœtal sac showing cross section of intact fallopian tube.

Physical examination was essentially negative except for the abdomen which showed a tumor in the lower mid-portion consistent with a 6 or 7 months pregnant uterus. The cervix was not taken up and the os admitted one finger.

June 25. Temperature 102°; pulse, 120: Her general condition remained the same.

June 29. The patient was running an irregular temperature, 100–102°. Pus was found in the urine.

July 1. An *ether examination* was advised since the patient had had no labor pains and as there was some possibility of there being a dead fœtus. The uterus was found to be normal in size and anterior to a large tumor the size of a full-term pregnancy. The diagnosis of ovarian cyst was made, and the possibility of an abdominal pregnancy was considered. Since the patient had given permission to operate it was decided to explore.

Operation. A low, median line incision revealed the intestines and the omentum adherent to a large tumor of the left ovary. The uterus was of normal size and anterior. The right tube and ovary were normal. The adhesions between the intestines and the omentum were separated with some difficulty—both surfaces of the adhesions bled considerably. When the tumor was more fully explored it was found to be adherent at the lower end to the broad ligament and to the bladder (that is, the pedicle of the tumor was attached to the broad ligament). The tumor seemed like a large ovarian cyst, with a thicker pedicle than normal. The wall of the cyst was much thicker and more vascular than is the usual cyst wall. After all the adhesions were broken up it was impossible to find the fallopian tube. It had probably been separated from the broad ligament in freeing the adhesions. The pedicle was tied off and the tumor was removed. On opening the sac of the tumor, a full-term fœtus surrounded by foul-smelling puriform amniotic fluid was exposed. It was impossible to find any ovarian tissue on the left side. The pedicle and the remnants of the broad ligament were sewed over with catgut. A drain was placed at the site of the tumor and the abdomen was closed in layers.

The patient made an uneventful convalescence and was discharged well, 16 days after the operation, 24 days after admission.

Examination at the time of discharge showed the uterus to be in the anterior position and of normal size. The right vault was free. The left vault was slightly indurated. Her general condition was excellent.

Pathological examination showed that this was a true ovarian pregnancy at full term. The specimen was a slightly oval mass 21 by 19 by 11 centimeters, weighing 2520 grams (5½ pounds). The surface was grayish white with many adherent tabs. On one side were the remains of a twisted pedicle by which the mass had been attached to the broad ligament. The mass was distinctly fluctuating. An incision 10 centimeters long disclosed the head and shoulders of a well-developed fœtus (Fig. 1). The legs, hands, finger nails etc., were perfectly formed, and there was no evidence of gill clefts or other embryonic structures indicative of anything but a full-term fœtus.

The placenta was attached to the inner wall of the mass, at the end opposite the head. The fœtus was somewhat macerated, the hair and epidermis had desquamated from the head and the shoulders. The body lay in thick yellow, puriform material.

In gross the wall of the mass appeared to be made up of tough fibrous material varying in thickness from 0.5 to 1.3 centimeters. The thicker portions lay over the region occupied by the placenta.

Vertical sections were taken through the wall of the sac at eighteen different places. On microscopic examination all of these sections showed dense fibrous tissue. In addition to this, sections from fifteen of these places showed the remains of corpora lutea—mainly corpora hæmorrhagica and corpora fibrosa. Several of these sections showed the remains of distended ovarian follicles. Others showed follicles with ova still in position (Fig. 3). One series of sections through the wall near the placenta showed not only follicles with ova, and corpora fibrosa, but also a cross section of the oviduct (Fig. 2). The tube was intact but greatly diminished in size owing to extension. Its lumen was about as big as an ordinary pin point—barely visible to the naked eye. Further sections cut along the probable course of the tube showed it to be present and intact. The fimbriated end was spread out over the external surface of the mass. Sections cut from the fimbriated end of the tube showed concentric layers of dense fibrous tissue about 2.5 centimeters thick through which were scattered smooth muscle fibers. Apparently the fimbrated end of the tube had become adherent to the surface of the ovary at some previous time so that when the ovum became impregnated, probably within a follicle, and the ovary enlarged, the tube became stretched across the surface of the organ and was caught in the fibrous tissue eventually formed, giving it the elongated appearance described above.

The microscopic evidence that this is a true ovarian pregnancy at full term is—

1. The presence of ovarian tissue (corpora fibrosa, follicles and ova) throughout the wall of the sac.

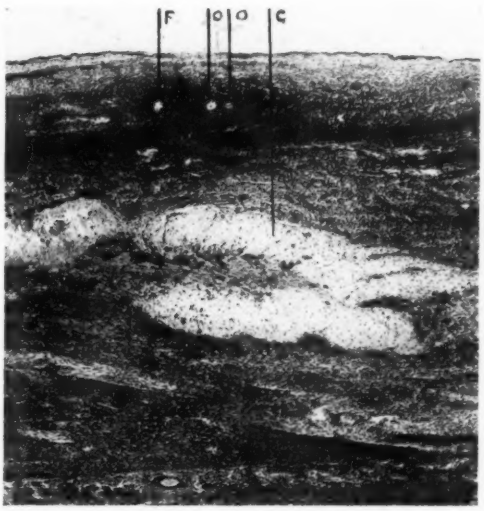

Fig. 3. Cross section of the wall of the fœtal sac showing these ovarian follicles, two containing ova, and corpora fibrosa. *f*, Ovarian follicle; *o*, follicle with ovum; *c*, corpora fibrosa.

2. The presence of the intact tube lying on the external surface of the sac.
3. The presence of the smooth muscle in the external portion of wall of sac, only in the region of the fimbriated end of the tube.
4. The absence of any embryonic structure in the fœtus.

The clinical evidence that this is a true ovarian pregnancy is that—

1. The fœtal sac occupied the normal position of the ovary.
2. No other ovary was found on the affected side.
3. The fœtal sac was connected to the uterus by the ovarian ligament.

THE TREATMENT OF HYDATIFORM MOLE AND CHORIO-EPITHELIOMA WITH A CONSIDERATION OF THE RELATIVE FREQUENCY OF EACH[1]

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VESICULAR degeneration of the chorion, or hydatiform mole, is a condition marked by characteristic microscopical and gross changes in the chorionic villi. Microscopically, we note in the individual chorionic villus, proliferation of the trophoblast elements and myxomatous changes in the stroma and an increase in the syncytium. Grossly, we have presented the characteristic grape-like mass of vesicles.

There is, at the present time, a great difference of opinion as to the frequency of hydatiform mole. Boinvin found that it occurred once in about 20,000 pregnancies; Gebhardt observed 12 cases in 16,000 pregnancies; Hirst states 1 in 3 to 4,000 pregnancies; Williamson 1 case in 2,400 pregnancies. A study of the gynecological records at Bellevue Hospital shows 21 cases during the past 11 years. We have admitted at Bellevue Hospital about 400 abortions a year, hence, out of approximately 4,500 abortions we have discovered 21 hydatiform moles, or 0.4 per cent. I say we have discovered 21 cases for I feel sure that many early cases have been overlooked. When one considers that this vesicular degeneration may be confined to only a small portion of the placenta and that careful examination is necessary to determine the presence of a few vesicles, the possibility of overlooking many cases is apparent. To determine properly the frequency of hydatiform mole one should study the aborted products of conception or placenta under water after careful washing. This causes the distended vesicles to rise to the surface and many cases of limited degree may thus be discovered. As to the frequency of occurrence of hydatiform mole, I am in accord with Meyer who states: "Indeed, how many cases of hydatiform degeneration one can find in abortuses will depend much upon the care with which the examination is made, for the condition undoubtedly is extremely common and not rare as heretofore supposed." It is of vital importance that the profession should appreciate the comparative frequency of hydatiform mole, for by this understanding only can we outline a proper treatment of the condition and only by an understanding of its frequency can we appreciate its relation to chorio-epithelioma, one of the most malignant neoplastic growths.

The mortality from hydatiform mole is at present variously estimated at from 10 to 25 per cent: Dorland stating 10 per cent; DeLee 16 per cent; Hirst 18 to 25 per cent; our series at Bellevue Hospital 9 per cent. The causes of death are given as hæmorrhage, sepsis, and the development of chorio-epithelioma. Both of the deaths in our series resulted from a low grade sepsis superimposed upon an anæmic state caused by a moderate but prolonged bleeding. Perforation of the uterus by the growing hydatid may result in internal hæmorrhage or in peritonitis. This is, however, an extremely rare complication.

Let us now consider chorio-epithelioma. This intensely interesting and but little understood tumor is characterized by a malignant proliferation of the chorionic epithelium. It is a true invasive tumor as its origin is always from the fœtal chorion, excepting the atypical or teratomatous type arising in the testicle. "Microscopically, this tumor is found to be made up almost entirely of broad, irregular, and ragged anastomosing strands of the two types of chorionic epithelium; Langerhans cells, which can be readily distinguished by their smaller and more regular form, with pale or almost clear protoplasm and fairly sharp cell outline, while syncytial material spreads over them or forms solid areas of protoplasm which stains much more deeply and in which numerous nuclei often of great size are imbedded." The confusion

[1] Read before the New York Academy of Medicine, Section on Obstetrics and Gynecology, April 25, and Brooklyn Surgical Society May 4, 1922.

Fig. 1. Gross picture of fully developed hydatiform mole showing the characteristic vesicles.

Fig. 2. Photomicrograph, low magnification, showing normal chorionic villi. Taken from a young embryo.

in the consideration of this tumor arises from two causes: first, its difficulty of diagnosis histologically, and, second, the variation in its malignancy. The difficulty in histological diagnosis is caused by its close resemblance to normal chorionic tissue, hence, portions of normal but long retained placental tissue may be misleading. As to the variations in its malignancy it is now generally accepted that the relative malignancy of this tumor can not be distinguished by the histological picture alone. This fact has been emphasized by Hitschmann and Cristofoletti, Aschoff, Pick and Schlagenhaufer, Geist, Fairbairn, and others. Ewing, however, has classified chorio-epithelioma in three distinct types dependent upon the histological picture. Chorio-adenoma-destruens, chorio-carcinoma, and syncytioma, he asserts that the prognosis can be given dependent upon the cell type and arrangement. This opinion, however, is not generally accepted, as I have stated.

It is apparent when one realizes the relative frequency of hydatiform mole that the percentage of occurrence of chorio-epithelioma following hydatiform mole must be low, much lower than is usually supposed. The rarity of death from chorio-epithelioma needs no emphasis. Dr. Douglas Symmers, director of the Bellevue Laboratories, states that during the past 11 years there have been approximately 8,000 autopsies at Bellevue Hospital and more than 35,000 surgical specimens have been examined revealing but one chorio-epithelioma. This, a metastatic chorio-epithelioma of the vulva, was designated as doubtful. If we accept, as we must, the statement of Meyer as to the frequency of early hydatiform mole, it reduces the percentage of chorio-epitheliomata following hydatiform mole to a minimum, probably to less than 1 per cent. The reason for the

great difference of opinion is, first, that many early hydatiform moles are not discovered, thus increasing greatly the actual number of moles, and, secondly many cases diagnosed as chorio-epithelioma are not so in fact.

That hydatiform mole is a precursor of chorio-epithelioma in a large percentage of the actual cases of chorio-epithelioma is an established fact. Pollosson and Violet state that 455 cases of chorio-epithelioma collected from the literature, showed a previous history of hydatiform mole in 366 instances. This is natural to suppose for it is but a slight transition from the syncytial hyperplasia of the vesicular mole to the actual malignant chorio-epithelioma. This, however, by no means permits of the conclusion that a large percentage of hydatiform moles is followed by chorio-epithelioma. Payne believes that about 50 per cent of hydatiform moles are followed by chorio-epithelioma. Findley states that in a series of 250 cases collected from the literature 16 per cent developed chorio-epithelioma, Hitschmann and Cristofoletti from a series of 200 moles show 7 per cent followed by chorio-epithelioma, Vineberg estimates that less than 5 per cent of hydatiform moles are followed by chorio-epithelioma. Gebhardt's series of 12 hydatiform moles followed for 4 years did not show a single chorio-epithelioma, DeLee reports 16 cases, none of which developed chorio-epithelioma. We have had but one chorio-epithelioma at Bellevue Hospital during the past 11 years and that a doubtful case.

I have spent this time in considering both hydatiform mole and chorio-epithelioma for an appreciation of the relative frequency of the former and a realization of the actual rarity of the latter is necessary before it is possible to arrive at a rational conclusion as to the treatment of hydatiform mole. The mole should be treated mainly from the standpoint of preventing hæmorrhage and sepsis; bearing in mind always the *remote* possibility of the development of chorio-epithelioma. This precludes such radical treatment as hysterectomy in all hydatiform moles, primarily for the fear of developing chorio-epithelioma, as has been proposed. We would thus be needlessly sacrificing many uteri and subjecting many cases to an unnecessary and dangerous operation. Curettage should always be avoided, for it is impossible to remove the larger part of the vesicles in this way and it is attended with great danger because of the possible thinning of the uterine wall by the growth. Hitschmann and Cristofoletti state that distant metastasis, as to the lung, is largely caused by surgical interference. As DeLee states, curettes and placental forceps should never be used, in the treatment of hydatiform mole. Vineberg has advised anterior vaginal hysterotomy with manual removal of the mole in all hydatiform moles occurring in women under 40 years of age and hysterectomy in those cases over 40 because of the possibility of chorio-epithelioma. Should the condition of the cervix permit manual uterine exploration, hysterotomy is, of course, unnecessary. This method has none of the dangers of instrumental evacuation of the uterus and it permits palpation of the interior of the uterus. This is a very important matter, for as Eden states and many others agree, a beginning chorio-epithelioma may be noted at the time of evacuation of the mole. The characteristic notation made with beginning chorio-epithelioma is a soft and friable spot in the myometrium from which almost necrotic tissue can be easily removed. Should such a spot be found, which notation will seldom be made, hysterectomy is advisable. By far the larger percentage of cases will be successfully terminated by the manual removal of the hydatiform mole. Such cases should, however, be observed carefully, as is generally agreed, for subsequent irregular uterine hæmorrhage. In the event of such a hæmorrhage, Vineberg advises immediate abdominal hysterectomy. May we not take issue with this form of treatment at this point? A diagnostic curettage in a questionable case of chorio-epithelioma, as is frequently suggested, is worthless, for the microscopical picture alone will reveal nothing or at best a doubtful report. It seems to me that in the event of irregular bleeding following hydatiform mole, a laparotomy with hysterotomy is the most advantageous procedure. By this method we should discover the occasional

Fig. 3. Photomicrograph, low magnification showing beginning hydatiform mole. Note the enlargement of many of the villi with myomatous change in the stroma. A mole of this type is noted only upon careful examination.

Fig. 4. Photomicrograph, low magnification, showing fully developed hydatiform mole with marked enlargement of the villi.

chorio-epithelioma which grows only toward the peritoneal surface of the uterus giving no appreciable change in the endometrium. Such cases are reported by Meyer and Nagy. An abdominal hysterotomy permits a thorough inspection of the uterus as well as palpation and in this way portions of placental tissue retained for a considerable time may be removed and thus many uteri saved. Should the laparotomy reveal evidence of chorio-epithelioma, of course the hysterotomy is uncalled for. The evidence of a chorio-epithelioma may be found in extensive thrombosis of the pelvic veins, or in the appearance of the uterine body.

The use of radium or deep X-ray therapy should be a great advantage in these cases. Probably because of the difficulty in obtaining a series of cases of either hydatiform mole or chorio-epithelioma, I can find no references in the literature as to the efficacy of this form of treatment. The malignant chorionic villus, and this term applies to the hydatiform mole as well as to chorio-epithelioma, should succumb readily to radiotherapy.

A consideration of this subject would not be complete without reference to a frequent accompaniment of both hydatiform mole and chorio-epithelioma; namely, bilateral ovarian cystomata. Coventry states that these cysts are found in 91 per cent of chorio-epitheliomata and in over 80 per cent of hydatiform mole. The histogenesis of these cysts is a matter of discussion; Seitz states that they arise from atresic follicles. Jaffe and Orthman state that they arise by distention and overgrowth of corpora lutea of various ages. The important point to be borne in mind as to this complication especially when it arises in connection with hydatiform mole is that the ovarian cysts are, as a rule, short-lived growths which show no sign of

malignancy and undergo spontaneous regression after the removal of the uterine condition.

CONCLUSIONS

1. Hydatiform degeneration of the chorion is not an infrequent condition.

2. Actual chorio-epithelioma is an extremely rare condition.

3. The relative malignancy of chorio-epithelioma can not be distinguished by the histological picture alone.

4. Hydatiform mole should be treated from the standpoint of hæmorrhage and sepsis, bearing in mind *only the remote* possibility of the development of chorio-epithelioma.

5. Manual removal of the hydatiform mole is the method of choice. If the condition of the cervix does not permit this, vaginal hysterotomy should be performed that manual removal may be possible.

6. Should chorio-epithelioma be suggested by the findings, at the time of removal of the mole, hysterectomy should follow.

7. Curettage is a dangerous and practically worthless procedure as a means of diagnosing chorio-epithelioma.

8. Abdominal hysterotomy, in late cases, suspected of chorio-epithelioma, is the procedure of preference as it permits visual examination of the pelvis as well as the uterine body and endometrium. By late cases I refer to cases with a previous history of pregnancy or hydatiform mole.

9. Radio-active therapy should be efficacious both as a prophylactic and therapeutic measure in chorio-epithelioma.

10. Bilateral ovarian cystomata accompany both hydatiform mole and chorio-epithelioma in over 80 per cent of the cases.

11. Bilateral ovarian cystomata in both of these conditions are short-lived, show no signs of malignancy, and undergo spontaneous regression after the removal of the uterine condition.

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FIBROMATA OF THE OVARY[1]

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IN the Mayo Clinic from January 1, 1910, to August 1, 1921, fifty-five fibromata of the ovary, not associated with other pathological conditions, were removed at operation. Diagnosis was confirmed by microscopic examination in all the cases in the series. During this same period a total of 4175 tumors of the ovary were removed. One hundred forty-nine (3.5 per cent) of these were fibromata, but 94 were associated with cysts, either benign or malignant, or fibromata of the uterus, and so forth, for which the operation was performed. The incidence of fibromata of the ovary is usually given in the literature as 2 per cent.

CASES REPORTED FROM THE LITERATURE

Fibromata of the ovary were first mentioned by Astruc in 1740, and were later discussed by Baillie, in 1799, and Kiwisch, in 1845. Olshausen, in 1873, found six fibromata of the ovary in a series of 293 cases of tumor of the ovary. In 1874 Leopold collected 59 cases from the literature, in some of which the diagnosis was questionable; in 1882, Coe reviewed 20 additional cases and in 1884, Wells found 3 such tumors in 1200 ovariotomies. In 1902, Peterson reported 82 cases from the literature with 2 of his own. Orthmann, in 1904, reported 10 in a series of 527. In 1905, Basso reviewed 4 cases from Leopold's laboratory, and in 1913, Danforth reported a case in which the tumor complicated pregnancy. In 1914, Fullerton reported one case and Hellman, in 1915, reported 6 cases collected from a series of 4,500 pathological specimens. Clark and Gabe, in 1921, published a paper in which such tumors were discussed. The relative frequency of fibromata of the ovaries and uterus is shown by Hartz who notes that Kelly and Cullen found only three fibromata of the ovary in a series of 934 cases of myomata of the uterus.

The primary origin of fibromata of the ovary has not been determined definitely, although these tumors have been referred to as similar to keloids. They do not have a tendency to recur, however, after removal as is characteristic of keloids. It is quite possible that they may arise from the stroma of the ovary, the corpus luteum, the corpus fibrosis, organized blood clots, the capsule of the organ, or the walls of the blood vessels. Klob, Peaslee, and Olshausen believe that their origin may be traced to inflammatory processes. Hæmorrhage and hyperæmia from mechanical causes are important factors. Infection plays a questionable part, but scirrhotic and retrogressive changes in the ovary at the menopause may be causes.

The tumors may occur at any age after puberty, but more often develop immediately before or just after the menopause. In the series of 55 cases, the greater number occurred during the fourth, fifth, and sixth decades. The youngest patient was 18 years and the oldest was 73. Two patients were between 10 and 19 years, 5 were between 20 and 29, 15 were between 30 and 39, 9 were between 40 and 49, 15 were between 50 and 59, 17 were between 60 and 69, and 2 were more than 70. Twenty-six of the patients were menstruating, 3 were at the menopause, and 26 were past the menopause. Five patients were from 1 to 5 years past the menopause, 10 were from 6 to 10 years past, 4 were from 11 to 15 years past, 4 were from 16 to 20 years past, 2 were 21 and 25 years past respectively, and 1 was 30 years past and had had symptoms during that period.

A study of the series of 55 cases shows that menstruation is seldom influenced by the tumors. This is in agreement with Doran's conclusions from his study of 11 cases. In 24 the menses were regular and practically normal. Five had irregular menses but 3 of these were at the menopause. In only 4 was the flow increased. One had increased flow for 2 years and 1 for 2 months. The youngest patient, 18 years, had not menstruated because of the congenital absence of the uterus and vagina. The average age of the 26 patients

[1] Extract from thesis presented to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Surgery, 1922.

past the menopause was 50.9 years. This is in accordance with Peterson's findings that fibromata of the ovary delay the menopause.

In Peterson's series 44 patients were married and 22 were single. Of the 45 in whom fecundity was mentioned, 33 (73.33 per cent) were sterile. In the 55 from the Mayo Clinic 41 were married, 4 were widowed, 1 was divorced, and 9 were single. Thirty of the 46 had children, 10 had one child each, 4 had two children each, 3 had three, 3 had four, 3 had five, 5 had six, 1 had seven, and 1 had ten. Thus, incidence of fibroma of the ovary was several times greater in married than in unmarried women. The number of children bears no relationship to the occurrence of the tumor.

Fibromata of the ovary may vary from 0.5 centimeter to more than 30 centimeters in diameter. The largest growth in the series measured 35 by 23 by 15 centimeters, and weighed 6023 grams. In one case in which the tumor was bilateral the growth in the right ovary was 17 by 15 by 9 centimeters, and that in the left ovary 18 by 17 by 11 centimeters. As a rule the tumor corresponds to the shape of the normal ovary, but its surface is nodular and irregular. Firmness depends on fibrous consistency or calcareous degeneration; the growths are softer with myxomatous degeneration. They are usually gray or grayish white. The cut surface is glistening white or yellowish white, owing to hyaline degeneration. If the blood supply is unusually rich they appear red or, in the presence of recent hæmorrhage, they may be black.

Microscopically a certain regular arrangement of the individual fibrous cells which frequently form bands or strands is found. If muscle cells are present, they may be derived either from the normal muscle cells of the hilus or the walls of the blood vessels. As a rule the muscle cells are few in comparison with the connective-tissue cells which are short and spindle-shaped, with a slightly bent or pointed nucleus. In large tumors there are practically no muscle cells, because of the interference with the blood supply by the contraction of the fibrous tissue. Practically all forms of degeneration may be seen microscopically; fatty, myxomatous, hyaline, hydropic, and calcareous are the most common. Large tumors contain extensive areas of necrosis. Fibromata may be distinguished pathologically from sarcomata by their less cellular structure and more regular arrangement of cells, and the absence of mitotic figures and embryonal types of cells.

The symptoms are subjective and objective. Among the subjective symptoms, which are comparatively few, is pain in the abdomen, usually dragging, unless the pedicle becomes twisted, when it is very acute and may cause collapse. The pain often radiates to the groin, when it simulates that of renal or ureteral stone. Occasionally pressure causes it to radiate along the distribution of the nerve trunks. Frequent and painful urination, constipation, and pain on defæcation are sometimes complained of. Aching in the lumbar or sacral region is often noted. The patient may not be aware of the tumor, even though it is large.

Objectively the tumor may be fixed by adhesions, but as a rule it is movable. The uterus, in some cases, moves separately from the tumor. Ascites is stated to be present in about 5 per cent of cases and may be due to irritation of the peritoneum. Olshausen believed it the result of mechanical irritation, Schauta attributed it to hyperæmia, and Pfannenstiel and Schatzchen to a secretion of the degenerating tumor. The tumor may be present for several years before it becomes large or gives rise to marked symptoms. However, there are a small number of cases in which the growth is more rapid and the tumor causes symptoms within comparatively few months.

In the 55 cases the tumor was known to be present from a few months to many years; in one case 30 years with comparatively few symptoms. Fifty-two of the 55 patients had symptoms. Seven had had symptoms from 1 to 6 months, five from 7 months to 1 year, sixteen from 1 to 2 years, six from 2 to 4 years, six from 6 to 10 years, one for 12 years, one for 14 years, one for 19 years, and one for 30 years. The duration was not stated in eight.

Pain, the most common symptom, was present in 33 cases, not mentioned in 17, and absent in 5. As a rule, it was not present in

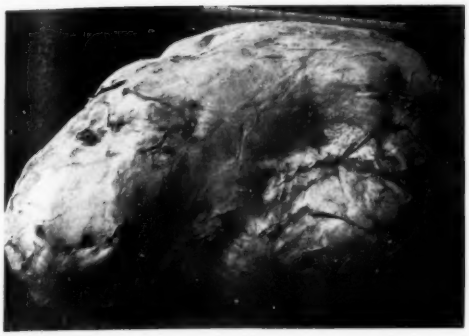

Fig. 1. Surface view of fibroma 35 by 23 by 15 centimeters. Weight 13.25 pounds. (Case A205277.)

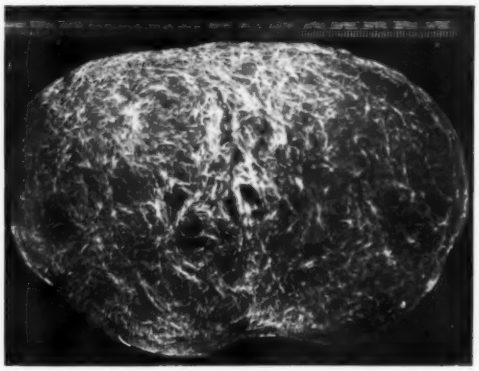

Fig. 2. Fibroma 15 by 11 by 10 centimeters. Striations on cut surface with small cyst in the center of the tumor. (Case A115013.)

the cases of the smallest or very largest tumors. The pedicle was twisted in two cases and caused severe pain and shock. Radiation of pain to the bladder and groin confused the clinical picture, but the paucity of urinary symptoms and negative urinalysis and roentgenograms aided in the differential diagnosis.

Pressure on the bladder and rectum caused symptoms in 26 cases. Frequency of urination was present in 14 of these. Desire to defæcate frequently was present in 2.

The tumor was definitely fixed in 4 cases and movable in 51. It was located in the midline of the lower abdomen and pelvis in 36 cases, in the right side of the pelvis in 12, in the left side of the pelvis in 5, and in the cul-de-sac in 2. Ascites was present in 14 cases (25 per cent). The amount varied from 0.5 to 16 liters. Two patients had also bilateral hydrothorax which disappeared after operation. When ascites is present the clinical picture may be confused with that of malignancy of the ovary, especially when loss of weight and strength are marked. However, the association of ovarian tumors and ascites should be remembered and exploratory operation offered to patients with tumors of the pelvis and ascites unless metastasis is demonstrable.

One ovary only was affected in 53 cases. Both ovaries were affected in the other two. The growths reported in the literature are practically always unilateral.

Twenty-four patients complained of tumor; 12 of abdominal pain; 6 of pelvic pain and distress; 2 each of frequency of urination, falling of the womb and metrorrhagia, and one of menorrhagia.

The diagnosis depends on the presence of a unilateral tumor of the pelvis, non-fluctuating and separate from the uterus. Often no definite diagnosis other than tumor of the pelvis can be made before operation. In the differential diagnosis must be considered pedunculated fibrous tumors of the uterus, solid carcinomata and sarcomata of the ovary, fibrous tumors of the tube, fibrous tumors or adenomyomata. It should be remembered that sarcoma is more common in young persons. Solid carcinomata cannot be absolutely differentiated unless metastasis is present. If ascites is present cirrhosis of the liver, abdominal malignancy, tuberculosis, and so forth should be ruled out.

TREATMENT

The treatment should be surgical, as medical treatment is of no avail. Radium and roentgen-ray therapy should be reserved for cases in which operation is contra-indicated on account of co-existent conditions, such as serious cardiac lesions and nephritis. Operation should be advised for the removal of all ovarian tumors as soon as the diagnosis is made, since malignant degeneration may occur, if it is not already present, or twisted pedicle with gangrene and peritonitis may develop.

The type of operation in the 55 cases varied according to indications found at operation. One ovary alone was removed in 12 cases, one ovary with its tube was removed in 21 cases. Both ovaries and tubes were removed in 6 cases. Subtotal hysterectomy with removal of one ovary and tube was performed in 6 cases, and subtotal hysterectomy with removal of both ovaries and tubes was performed in 7 cases. When both ovaries were removed from patients who had not reached the menopause, one ovary or a part of one ovary was transplanted. Total hysterectomy with removal of both tubes and ovaries was performed in three cases. The uterus was removed in these cases for various reasons, such as prolapse, multiple small fibroids, fibrosis, and chronic endometritis. The appendix was removed in 37 patients; cholecystectomy and gastro-enterostomy for duodenal ulcer were performed in one case. In one case the tumor was found to be parasitic to the omentum and small intestine.

PROGNOSIS

The prognosis is good, especially when solid carcinoma and sarcoma have been ruled out by microscopic examination of the tumor. Pre-operatively and when the patient refuses operation, the prognosis is influenced by the possibility of twisted pedicle with resulting infection, gangrene, and peritonitis, malignant degeneration, and so forth.

In order to ascertain the results following operation, questionnaires were sent to the patients. Particular stress was placed on the effects on menstruation and on the occurrence of pregnancy. Twenty-six patients answered the questionnaires. Of these 10 had not reached the age of menopause and were anatomically able to menstruate. Nine of the 10 menstruated regularly. One ceased menstruating after operation. In 8 the flow was normal in amount; in 1 it was increased. Only 1 complained of dysmenorrhœa. Of the 26 who answered questionnaires, 6 were married, still menstruating, and physiologically and anatomically capable of bearing children. Of these 6 patients, 3 had children after operation; 1 had two children and the other 2 each one child. Practically all patients reported freedom from the symptoms of which they had complained before operation, and general health and strength were good.

CONCLUSIONS

1. Fibromata of the ovary may occur at any age after puberty; they comprise 3.5 per cent of all ovarian tumors.
2. There may be comparatively few symptoms and the tumor may be present a long time without the patient's knowledge.
3. Ascites and tumor of the pelvis do not necessarily mean abdominal malignancy.
4. The treatment is surgical. All ovarian tumors should be operated on as soon as diagnosed.
5. The prognosis is good.
6. Menstruation is usually regular and normal in amount as could be expected following unilateral ovariotomy.
7. Normal pregnancy may occur in patients of child-bearing age, when only one ovary, or one ovary and one tube, has been removed.

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INTRACRANIAL AEROCELE FOLLOWING A FRACTURE OF THE SKULL

REPORT OF A CASE WITH REVIEW OF THE LITERATURE

BY FRANCIS C. GRANT, M.D., PHILADELPHIA
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DURING the past few years cases of intracranial aerocele have been reported from time to time with increasing frequency. With the improvement in the methods of X-ray diagnosis and the routine roentgenography of head injuries, more and more cases of this interesting condition will be noted. In view of this fact it seems important that the terminology to be applied to the condition be definitely settled. Reliable authorities have spoken of the condition as a pneumocranium. To this we object. "Pneumocranium" has no definite meaning. "Pneumocele" or "aerocele" connotes a swelling or tumor containing air. "Intracranial" localizes the position of this air. "Traumatic" might be added to the title as the condition is invariably preceded by an injury to the cranial bones.

In reviewing the cases of intracranial aerocele for the past few years, several facts bearing upon its etiology and development stand out clearly. Trauma of the frontal region of the skull involving the sinuses, a compound comminuted fracture resulting in a tear of the dura which permitted the ingress of the air was the commonest cause of the condition. But any compound fracture with a dural tear, whether the sinuses are involved or not, may be followed by the formation of an aerocele. The air is always intradural. In none of the ten cases embodied in this report was the presence of the intracranial air suspected until shown by a roentgenogram. In 6 of these cases the aerocele developed insidiously and was found by X-ray at intervals varying from a few days to several months after injury. The original injury was comparatively trivial and only the persistence of cranial symptoms after the accident suggested the necessity for another roentgenogram. In the earlier cases the finding of the area of decreased density due to the air confused the X-ray diagnosis, as its exact significance was not at once appreciated. Fortunately for us, a similar case had occurred in this clinic about 18 months previously and the presence of air as the cause of the shadow had been confirmed at operation and autopsy. In view of this experience and with the knowledge gained from ventriculograms, the meaning of the shadow cast by the air was at once apparent.

The case we report follows the general type in most particulars.

A. C., male, age 19, entered the University Hospital on the service of Charles H. Frazier on March 28, 1921. While driving his automobile a collision occurred and he was thrown from his car, striking upon his forehead and face on a macadam road. Past medical, family, and social history unessential. On admission patient was unable to carry on a clear conversation; he was mentally confused and very restless. A large hæmatoma was present on left forehead with brush burns and a small abrasion over right eye. The eyes showed no ptosis or extraocular palsies; the left pupil was slightly larger than the right; no nystagmus; eye grounds negative. There was much bleeding from the upper portion of nose, the blood dropping down into the pharynx. The mouth was negative. There was no bleeding

TABLE I.—SUMMARY OF CASES OF AEROCELE REPORTED IN PAST FEW YEARS

Case No.	Author	Age	Sex	Cause of Injury	Type of Injury	Unconscious	First Diagnosis	Neurological Examination and Diagnosis	First X-ray Diagnosis	Second X-ray Diagnosis	Operation	Necropsy Findings Remarks
1.	Luckett and Stewart (1)	47	M	Trolley car	Laceration of scalp over R. eyebrow. Compound fracture of skull	No	Fractured skull	Examination and diagnosis neg. possible brain abscess. Diagnosis on second admission	Fracture of right orbital plate and vault beneath skin laceration. X-rayed within 24 hours of injury	20 days after first X-ray Fracture as before. Air now seen in ventricles especially in anterior horn of R. ventricle	R. subtemporal decompression. Probe introduced into ventricle evacuated air. Suboccipital craniectomy showed air in basal cistern	Died 5 days later. Necropsy showed fracture of R. frontal sinus and orbital plate with laceration of base of R. frontal lobe and overlying dura. Sneezing apparently had forced air up into ventricles. Patient showed signs of meningitis before death
2.	H. E. Potter (2)	40	M	Fall from height	Contusion of forehead. Fracture not suspected	No	Contusions to hand, face, and jaw	Negative	19 days after injury. Frontal skull fracture, comminuted stellate centering about R. supra-orbital arch involving both internal and external walls of frontal sinus and orbital plate without depression of fragments. Beneath point of fracture was a gaseous accumulation as large as hen's egg	X-ray 2 weeks later showed increase of gas. Lateral ventricle partially gas filled. X-ray 6 weeks later showed gas all absorbed	None. No signs of intracranial pressure, meningitis or hæmorrhage	Patient recovered completely
3.	R. J. May (3)	55	F	Struck by auto	Scalp wound of occipital region. Numerous contusions of face	Yes	Fractured skull	None made	Patient moribund on admission. X-ray post-mortem showed fracture of R. frontal bone extending into R. frontal sinus Large crack at base beginning in floor of sella turcica and passing down through sphenoid sinus into nasopharynx. Large air space in frontal region		None. Never recovered consciousness after injury	Necropsy not obtained
4.	Skinner (4)	?	M	Gas well explosion	Laceration over right eye	?	?	Severe persistent headaches and dizziness	4 weeks after injury X-ray showed round area of increased transparency in anterior part of cranial cavity on R. Also fracture of right supra-orbital ridge the comminutions of the fracture extending into and through posterior wall of frontal sinus. Air cavity as large as an egg		Trephine opening and insertion of probe allowed escape of gas. Good operative recovery but 10 days later patient developed signs of meningitis and died	Necropsy disclosed leptomeningitis and large amount of pus at base of brain
5.	G. W. Holmes (5)	?	M	Aeroplane propeller	Laceration of face and forehead	?	Fractured skull	None	Linear fracture through outer table of frontal bone and possible continuation of fracture through inner table. Frontal sinus involved. Irregular area of decreased density seen in frontal region on R. thought to be artefact	Same as first. Area of decreased density still seen though smaller. Now considered to be air. Patient developed signs of meningitis	Drainage of frontal area. Small crack found in middle part of anterior wall of R. frontal sinus. Anterior wall of sinus removed and sinus found to be filled with clots. Posterior wall of sinus removed down to dura. Dura opened and pus and air escaped. Drained. Patient died 2 days later	Necropsy confirmed operative findings. Meningitis of frontal lobes

6.	G. H. Horrax (6)	10	F	Collision between auto and trolley	Lacerations over left orbit	?	Fractured skull	None at first; 3 months later (1) Weakness R. 7th (2) Blindness O. D. (3) Deafness R. (4) Loss of smell (5) Indications of damage to frontal lobes witzelsucht. Cranial defect over left frontal region	1st X-ray immediately after injury. Compound comminuted and depressed fracture of skull reaching from vertex slightly to L. of midline downward and forward and through L. orbit. Linear fracture extending backward to occiput, forward through both orbits and presumably through base of skull	3 months later X-ray showed area of decreased density over L. frontal region from near vertex down to left orbit. On comparison with plates taken 2 months before and one month after injury same area seen. Second plates show in addition lobulated shadow resembling a mass of bubbles seen under bone defect. This shadow extended backward into cerebral tissue for a considerable distance. Origin of air: crack in frontal sinus	None. No operative indications	Recovery
7.	Doyle (7) and Spiller (8)	50	M	Auto accident	?	Several days	Fractured skull	Fainting spells. Loss of memory. Sphincter loss became stuporous and developed signs of intracranial pressure	3 months after injury X-ray showed fracture running into frontal sinus from left temporal region and collection of air in left temporal region		Operation indicated to allow escape of air. Trephined in left temporal region and air escaped on opening dura with hissing noise. Died 6 days later	Necropsy: Clot between dura and bone, dura and cortex. Air escaped from cyst size of hen's egg. Dura lacerated over cribriform plate of ethmoid. Probe passed from base of anterior fossa into nose. Bony roof of orbit bulged toward cranial cavity
8.	Cotte (9)	?	M	Fall	Laceration about nose and forehead	Yes	Fractured skull	Disoriented and had difficulty in speaking	None at time of original injury. Several months after injury X-ray showed a large frontal area of decreased density	None	Trephine to relieve signs of increased intracranial pressure and subsequently a cranioplasty to repair defect caused by original injury	Patient refused further operation. On discharge complained of a gurgling sound on shaking his head. A free flow of cerebrospinal fluid was noted from nose prior to second operation
9.	H. M. Imboden (10)	62	M	Blow from hammer	Lacerations	Yes	Fractured skull	None. Recovered	Frontoparietal region showed a depressed fracture of skull beneath lacerations. X-ray, Oct. 11	On Nov. 8 following, dizziness and an epileptiform convulsion. X-rayed again and area of decreased density seen beneath area of original fracture. A third X-ray Dec. 2 showed no area of decreased density	Depressed fracture raised. Several pieces of loose bone removed. Dura lacerated and repaired with rubber tissue. Wound healed but a sinus remained for a month. Cleared up when another piece of bone came away	Patient recovered. No symptoms noted referable to injury
10.	Glenard and Aimard (11) Barbe and Glenard (12)	28	M	Bullet	Penetrating wound in fronto-temporal region	Yes	Through and through bullet wound. Both tables involved at entrance and exit	None made. Wound took 2 months to heal and cerebrospinal fluid fistula developed. This healed later and fluid leaked from the nose	2 months after injury X-ray showed large area of decreased density above cranial defect. Fluid level noted and a splashing sound could be heard when patient shook his head	5 months after injury area of decreased density due to air had disappeared. Neurological examination at this time negative except for slight loss of memory and headaches localized to cranial defect	None	Patient died of influenza 6 months after injury. Autopsy showed a well-defined cyst in frontal lobe and tip of temporal lobe. Dura firmly adherent to skull. Cavity contained 25 c.cm. of clear yellowish fluid. Cyst lining resembled ependyma of ventricle

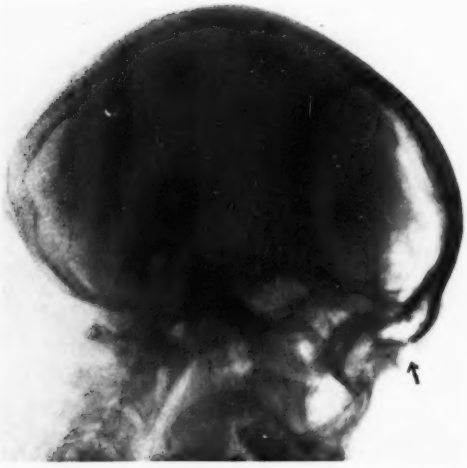

Fig. 1. Roentgenogram taken on admission showing aerocele in frontal region. Arrow points to point of fracture into and through the frontal sinus.

Fig. 2. Roentgenogram taken two days after that shown in Figure 1, showing air still present but in decreased amount. Arrow points to line of fracture.

from the ears; the drums were negative. The neck showed no rigidity; otherwise negative. Examination of chest showed nothing abnormal except for some pain over the left upper ribs. Examination of abdomen was negative; no tenderness, masses or rigidity. The arms showed no weakness, reflexes normal. Brush burn inside left arm. Crepitus and pain were found on outer side of the left tibia at the knee joints; otherwise the legs were negative. Achilles reflex present and equal in right and left. Patellar reflex normal in right, no Babinski or clonus.

Patient continued to bleed from nose and pulse went up to 112. He vomited twice large quantities of blood. About 5 hours after the accident he stopped bleeding.

Blood examination showed red corpuscles 4,890,000; white corpuscles 28,600; *Type II.*

Patient was delirious all night. Lumbar puncture showed pressure of about 2 millimeters of mercury; fluid was very bloody.

March 29, 1921, X-ray report showed a fracture through frontal sinus region and large traumatic intracranial aerocele; also a fracture of head of tibia.

March 31, 1921. Blood examination showed red corpuscles 3,040,000; white corpuscles 9,200; hæmoglobin 80 per cent. The condition remained about the same. There were no signs of paralysis anywhere. Lumbar puncture showed pressure of 20 millimeters. Nine cubic centimeters of fluid removed and pressure fell to 12 millimeters. The fluid did not contain as much blood as it did yesterday, but patient is more restless than yesterday.

April 1, 1921. X-ray examination gave about same appearance as at previous examination. There was no increase in air.

In view of the fracture through the frontal sinus and the aerocele it was decided to operate. Even though the plates taken 3 days apart showed no increase in the amount of intracranial air, we felt that an attempt should be made to find and close the tear in the dura through which the air had entered. It was feared that infection might pass in from the frontal sinus, producing meningitis.

April 2, 1921. A T-shaped incision was made. The vertical limb of the T was made in the mid-line, the horizontal limb about 7 centimeters above the eyebrow. Triangular flaps were reflected upward and downward. Osteoplastic flap was raised after drilling 4 holes in the 4 corners of the wound. The osteoplastic flap was raised without difficulty and the dura was found to be normal. On incising the dura, air escaped in small quantities followed by cerebrospinal fluid under considerable pressure. The horizontal edge of the flap had been placed too high so that it was not possible to dislocate the frontal lobe sufficiently to reach the floor of the anterior fossa or the dura over the antero-inferior part of this lobe. In attempting to do this, severe bleeding was encountered in the anterior central portion of the dural incision. This was controlled with considerable difficulty by tamponing and it was found necessary to leave the tampons in the wound and close it with them in place.

Patient's condition was poor but following blood transfusion condition was satisfactory.

A second operation became necessary to remove the tampons.

Exploratory craniotomy, April 5, 1921. Ether anæsthesia, endopharyngeal. The stitches were

removed. The vertical incision was extended down to brow, flaps reflected, and wound covers applied. Bone flap was removed and placed in warm normal saline solution.

Puncture of the dura was made in the frontal region and a few bubbles and a dram or two of straw-colored fluid escaped. However, there was no evidence of any large collection of air, and we assumed that the communication between the sinus and the nasal chamber had been obliterated. The dural puncture was closed and, little by little, all the tampons were removed without recurrent bleeding.

While the wound was being closed it was irrigated with hot normal saline solution.

The postoperative recovery was rather tedious but uneventful. Just what caused the dural rent to close we do not know. It was not seen at either operation. Possibly some of the blood from the free hæmorrhage encountered filtered down to the base of the frontal lobe and plastered over the opening. Whatever the process may have been the air did not reaccumulate as subsequent X-rays showed.

April 15, 1921, final X-ray report: The bone flap is in good position. No area of decreased density due to air is to be seen.

In the light of our experience with this case and from consideration of the case reports from the literature, we feel that in all cases of compound comminuted fracture of the skull, especially of the frontal areas of the skull which may involve the basal sinuses, the possibility of an intracranial aerocele should always be considered. Even in the absence of an apparent skin laceration the fracture may be compound internally into the sinuses with a tear in the dura through which the air may be forced. If the air is not seen in the first X-ray, the roentgenogram should be repeated subsequently at intervals a month or more apart, particularly if signs of increased intracranial tension develop. The presence of a pneumocranium immediately after the injury is an indication for operation at once to attempt to close the dural tear, thus minimizing the danger of infection. If the air is unexpectedly discovered after 5 or 6 days, when the sinus may have spontaneously closed, and if on repeated X-ray the quantity of air shows no increase and is causing no symptoms, a policy of watchful waiting should be instituted. Air *per se* once the possibility of infection can be excluded is relatively innocuous; it will be absorbed and no harm result. The patient should be

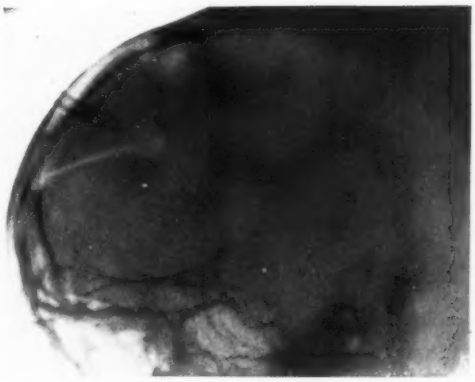

Fig. 3. Roentgenogram taken two weeks after operation showing absence of air in frontal region under bone flap.

warned against coughing or sneezing, which might reopen the sinus and force more air into the subdural spaces. Urotropin should be administered. The nose should be douched gently with a weak antiseptic solution. In our case, if presented again with a similar condition, the propriety of surgical interference 4 days after injury with no (apparent) increase in the size of the pneumocranium would be seriously questioned. We should have operated immediately after the first X-ray made the diagnosis. The second plate should have told us that as the quantity of air had not increased the sinus was probably closed and that close observation to catch the first signs of symptoms which would require free drainage for their relief was sufficient. Unless these symptoms arise, operation is contra-indicated in late cases.

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A NEW METHOD OF GALL-BLADDER DISSECTION, WITH A CONSIDERATION OF THE SURGICAL ANATOMY[1]

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From the Department of Surgery, Rush Medical College

In offering a new procedure in the dissection of the gall bladder, my purpose is to lessen the chances of injury to the blood vessels and bile ducts and to facilitate the removal of the gall bladder. Three factors necessary in order to reduce the operative risks, are: first, a thorough knowledge of the anatomy and of the variations frequently found in this region; second, a knowledge of pathological variations; and third, an improvement in operative technique to avoid accidental injury to important structures.

That the present methods used in the removal of the gall bladder are not satisfactory is evidenced by the frequent injuries of the bile ducts and the occurrence of hæmorrhage. In a review of the cases of operative injury to the bile ducts, Eliot stated that the most frequent cause was due to injury during cholecystectomy. This has been the experience of other surgeons. Balfour and Ross state that out of 16 cases of biliary fistula due to injuries of the bile ducts at operation, 13 had had the gall bladder removed.

Other sequelæ of bile-duct injury are well known. Hæmorrhage may be due to a failure in clamping, or tying the cystic artery or its branches. A bloody field is also a cause of many injuries to important structures. Ligation of the hepatic artery or its branches has been pointed out clinically by Kehr, Thoele and others to cause serious changes in the liver, and Thoele states that necrosis of a lobe of the liver is a fairly constant result from ligating its corresponding arterial branch and necrosis of the entire liver may result from ligating the hepatic artery unless there is abundant collateral circulation. He found it possible, experimentally, in some cases to suture the omentum to that lobe where the artery was ligated and establish a collateral circulation. The ligation of the hepatic artery may not cause fatal changes in the liver of carniverous animals, but in the herbiverous, it usually results in death (Behrend, Mayo).

The two accepted methods of gall-bladder removal are: one, from the fundus toward the cystic duct; the other, from below up. The latter method was popularized and has been most widely used following the recommendation of Mayo, Moynihan, and Erdmann. This has been the method chosen by most operators where there is only slight disease in or around the gall bladder.

In the presence of extensive changes, as empyema, œdematous friable tissues, or extensive adhesions around the bile ducts, one is confronted with a difficult dissection and much danger of injury to important structures. Here all have agreed that it is wise to abandon an attempt to dissect by the classical method from below up for one of the following procedures. If it seems wise to remove the gall bladder, it may be dissected from the fundus down, or where that is difficult, one may split the gall bladder, and follow the mucosa down to the cystic duct, and into the common duct (Mayo, Bevan). Stripping away the mucosa may occasionally be chosen (Mayo). A subserous dissection by splitting a thickened serosa may be done (Kehr, Courvoisier, Andrews). The performance of gall-bladder drainage may be preferred to cholecystectomy in difficult or selected cases.

Judd, Yates, and Masson state that they use the older method of dissection from the fundus down only in the more difficult cases. However, on account of the number of accidents to the bile ducts and occasional hæmorrhage from the cystic artery, there has been a failure not only in adoption of the newer method from below up by all surgeons (W. Meyers), but there has been a reversion by some men to the routine use of the older method of dissection from the fundus down, because they believe it to be safer (Seelig). Objections to this dissection from the fundus down are several. There is bleeding from branches of the cystic artery, which are re-

[1] Read before the Chicago Surgical Society, November 3, 1922. (For discussion, see p. 292.)

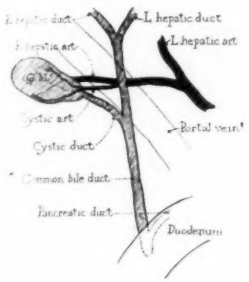

Fig. 1.

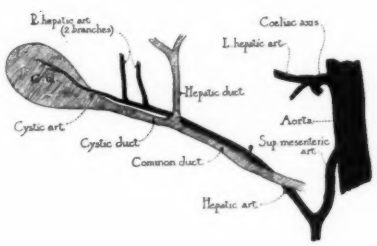

Fig. 2.

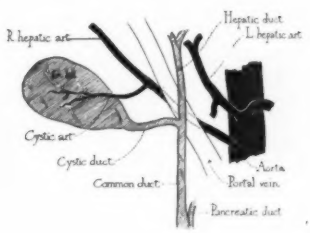

Fig. 3.

Fig. 1. The most frequent of the four relations classed as normal where the hepatic branch to the right lobe of the liver passed posteriorly to the bile duct and then gave off the cystic artery. This occurred 14 times. In the second relation the hepatic branch passed anteriorly to the bile ducts 5 times. In the third, the cystic artery arose at the left of the bile ducts and passed posteriorly to the bile ducts 3 times. In the fourth, the cystic artery passed anteriorly 6 times.

Fig. 2. A common anomalous origin of the cystic artery and of the branch to the right lobe of the liver from the superior mesenteric artery, four cases. In two, this included the only artery to the right lobe of the liver, while in the other two there was a branch from the hepatic artery. With this relation of the right hepatic artery and the common duct the artery might be cut in operating upon the common duct.

Fig. 3. The anomalous branch to the right lobe of the liver giving off the cystic artery arises directly from the aorta. It passes posteriorly to the portal vein as did two of the hepatic branches arising from the superior mesenteric artery.

peatedly cut, and from the liver, and anastomosing blood vessels. This creates a bloody field during the most difficult part of the dissection. Traction cannot be made safely on this freed gall bladder on account of the danger of tearing the cystic artery, pulling off the cystic from the common duct, or of clamping the distorted common bile duct with the cystic duct (Douglas, Phemister). The presence of a normally attached gall-bladder fundus for elevating and steadying the liver and bile ducts is not always properly appreciated. Where pathological changes are present, the difficulties in the dissection from above down, are increased.

Objections to dissecting from below upward are due to difficulty in isolating the cystic duct and artery, without injury to other bile ducts and important blood vessels. This method is exceedingly dangerous because of the frequent anatomical and pathological variations of the bile ducts, the neighboring blood vessels, and also those variations which may be due to the surrounding viscera. It becomes very difficult and dangerous in the presence of adhesions, a thick, friable and distended gall bladder, a short or dilated cystic duct, and in a different exposure, due to a thick abdomen or overhanging liver.

A year and a half ago, I evolved this new method under difficult conditions with an œdematous, friable, and thickened gall bladder filled with stones, showing beginning gangrene. I have found it satisfactory in the presence of a variety of pathological changes. In addition to pathological changes, where I have found the procedure less difficult than the classical method, there must be a sound anatomical basis for it not only to avoid injury to the normally placed bile ducts, blood vessels, and viscera, but to the frequently variable relations and anomalies among them.

SURGICAL ANATOMY

There are four relations between the cystic artery and the bile ducts which are so frequent that they may be called normal: first, and most frequent, the hepatic artery or branch to the right lobe of the liver with normal origin passes posteriorly to the bile ducts and gives off the cystic artery at their right, as was found 14 times (Fig. 1); second, the hepatic artery passes anteriorly before giving origin to the cystic artery, found 5 times; third, the cystic artery arises at the left of the bile ducts and passes posteriorly to them, 3 times; fourth, the cystic artery arises at the left, and passes anteriorly to the bile ducts, 6 times.

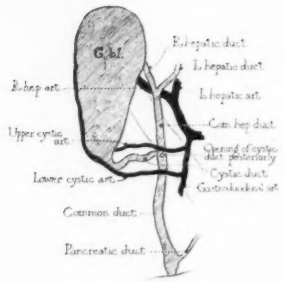

Fig. 4.

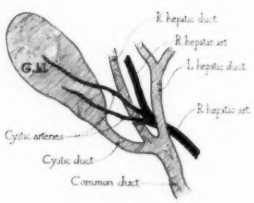

Fig. 5.

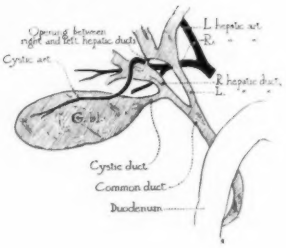

Fig. 6.

Fig. 4. A rather commonly described anomalous origin of the cystic arteries from a branch not going to the liver, the gastroduodenal artery. This origin was found once in my series. The cystic duct opens posteriorly into the hepatic duct.

Fig. 5. The cystic duct opens into the right hepatic duct which might easily be caught with the cystic duct mistaking the left hepatic for the common hepatic duct. There is usually no anastomosis as occurs in Figure 6 to compensate for an injury to the right hepatic duct.

Fig. 6. Anomaly of the bile ducts. There is a double hepatic duct with a communication at the upper end. The cystic duct opens into the right duct, which might easily be caught and injured.

In the remaining 9 instances of the 37 cases studied, there was a very unusual origin, number, or course of the cystic artery, and they were classed as anomalies. The cystic artery arose in these cases at the left in 3, and crossed the bile ducts anteriorly in all 3 cases. In 7 instances the cystic artery arose at the right of the bile ducts, while the branch to the right lobe of the liver from which it came, passed the bile ducts posteriorly in all cases. In one instance of double cystic artery, one artery arose at the left of the bile ducts and crossed anteriorly from a left hepatic branch, while the other artery arose at the right of the bile ducts from the right hepatic, which came from the superior mesenteric artery.

Since with the origin of the cystic artery at the left of the bile ducts, there would be less danger of injury to its source, the main arteries which supply a lobe or the entire liver, than if these vessels passed to the right of the bile ducts, the frequency of these relations was determined.

In 12 cases the cystic arteries arose at the left of the bile ducts from some hepatic branch. In 3, the arteries passed posteriorly, and in 9 the cystic arteries passed anteriorly to the bile ducts, but in 6 of these the right hepatic branch gave off the anterior cystic artery, and then passed posteriorly to the bile ducts.

The cystic arteries arose at the right of the bile ducts in 26 cases. Here in ligating the cystic artery, there would be a greater possibility of injuring the arterial blood supply which passed to the liver. These blood vessels to the liver, giving origin to the cystic artery at the right of the bile ducts, crossed anteriorly 5 times and posteriorly 21 times. In 20 instances, the vessel which gave off the cystic artery was the only branch to the right lobe of the liver, 4 of these having an anomalous origin. In 3 other instances, where the right hepatic was anomalous in origin, there were accessory branches to the right lobe of the liver from the cœliac artery. In one instance, there were multiple normal right hepatic branches. In two instances the common hepatic artery passed to the right of the hepatic duct in close relation to the cystic duct, exposing itself directly to injury and might be mistaken for the cystic artery or clamped with the cystic duct.

Thus in over two-thirds of the cadavers dissected, there would have been danger of ligating or injuring a large hepatic blood vessel in ligating the cystic artery and duct, and in two of them, interrupting the blood supply to the entire liver.

Origin of the cystic artery from an anomalous hepatic branch which did not come from the cœliac artery occurred in 5 instances. In 4 of these the cystic arose from a right hepatic branch which came from the superior mesenteric artery (Fig. 2). In only two of these four cases were their accessory normal branches to the right lobe of the liver from the cœliac

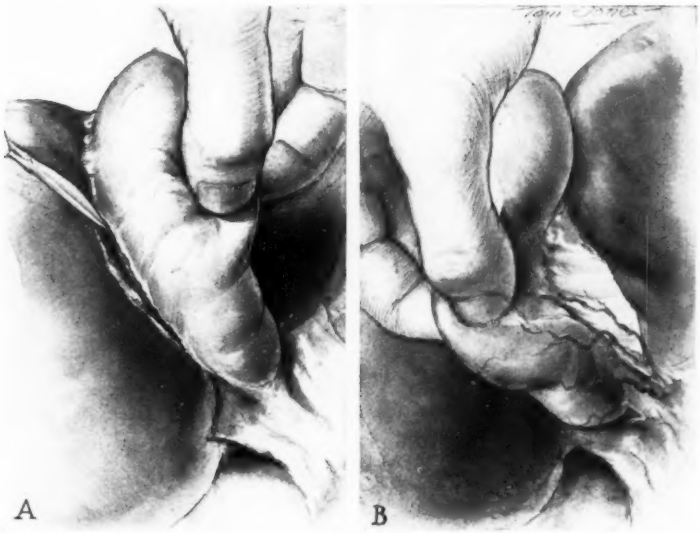

Fig. 7. a (at left). The incision at the side of the gall bladder near the pelvis where posterior dissection is started.
b. The gall bladder has been freed from the liver posteriorly in this region and from its left peritoneal attachment. An opening may now be made through the peritoneum on the left of the gall bladder. Any blood-vessel branches are ligated.

artery. In the fifth an accessory right hepatic artery arose from the aorta and gave off the cystic artery (Fig. 3).

In the 5 instances where a right hepatic branch arose from the superior mesenteric or aorta, it passed posteriorly to the portal vein 3 times and anteriorly twice.

The hepatic artery, one of its branches or the cystic artery, ran to the right of the common or cystic bile ducts and parallel for some distance in the edge of the gastrohepatic omentum in 5 instances. Where the hepatic branch arose from the superior mesenteric or aorta, it passed nearly the whole length on the right of the common duct and would be exposed to operative injury (Fig. 2).

The cystic artery was double three times in the 37 dissections, in the first of which there were two cystic arteries which arose from the gastroduodenal artery (Fig. 4); in the second, both came from the right hepatic artery (Fig. 5); in the third, one cystic artery came from the left hepatic branch, and the cœliac artery, while the other cystic artery came from an anomalous right hepatic branch originating from the superior mesenteric artery.

The cystic artery usually runs anteriorly to the cystic duct in its distribution to the gall bladder. Rio Branco states that near the region of the neck it divides into its peripheral branches.

Anomalies of the portal vein, which expose it directly to injury in operations on the gall bladder or ducts are unusual. However, Knight recently reports such an anomaly of the portal vein found in the dissecting room. The portal vein in this case was in front of the duodenum, common bile duct, and hepatic artery.

The gall bladder. There may be congenital absence of the gall bladder, displacement to the right or to the left, or variation in size and shape (Descomps, Kehr). The most frequent displacement is attachment to the left lobe of the liver. Pathological changes may occur, resulting in all types of deformity or displacement. Brewer states that usually one-third to one-fourth of the surface of the gall bladder is not covered by peritoneum, but that in 5

Fig. 8. The inferior portion of the gall bladder and cystic duct have been entirely freed from the liver and are exposed posteriorly. The lower end of the gall bladder is rotated to the left, and the cystic duct is enucleated from the peritoneal fold.

per cent of cases there is a distinct mesentery to the gall bladder.

The bile ducts. There is relatively less variation, fortunately, in the bile ducts than in the blood vessels. In only one of 100 cases did Brewer find any variation in the number of the bile ducts. Here there were two auxiliary ducts from the right lobe. He did find considerable variation in the length of the various ducts. One or even all of the bile ducts have been found to pass directly into the hepatic side of the gall bladder (Kehr).

Mayo has pointed out the importance of remembering that the cystic duct has its origin on the posterior wall above the lowest point, and that the pelvis of the gall bladder usually overlaps the cystic duct on its inferior and inner aspects. Quite frequently there is a little fold of peritoneum connecting the pelvis of the gall bladder with the gastrohepatic ligament over the common duct, forming a small suspensory ligament.

Eisendrath worked out, especially, the types of junction of the cystic and hepatic ducts. He found four types: the acute angle, the short parallel, the long parallel, and the spiral types. In my study of the lengths of the various ducts, I found that the cystic duct averaged 2.5 centimeters in length in 20 cases; in 35 cases, the hepatic duct averaged 3.0 centimeters and the common bile duct 6.24 centimeters in length.

There was great variation in the point of insertion of the cystic duct. In a study of the junction of the cystic and hepatic ducts, I found the junction forming an acute angle in 26 cases, an obtuse angle in 3 cases, and found 8 cases to be of the spiral type. In the spiral type the cystic duct opened on the posterior of the hepatic duct 7 times, and in the other case, passed over the hepatic duct and entered on the left side. In one case there was what appeared to be a double hepatic duct with a communication above and the cystic duct entering the right one (Fig. 6). In one case the cystic entered the right hepatic branch above its junction with the left duct (Fig. 5). This left hepatic branch might easily be mistaken, at operation, for the common hepatic bile duct, and the right hepatic branch clamped with the cystic duct.

There was one instance of an accessory anomalous left hepatic duct. This emptied into the common bile duct below the junction of the cystic duct.

TECHNIQUE OF THE NEW PROCEDURE IN THE DISSECTION OF THE GALL BLADDER

An adequate exposure is necessary. Greater mobilization of the liver may be obtained by cutting the round ligament. A distended gall bladder may first be aspirated and partially collapsed. This will permit of traction on the fundus and pelvis, if desired. However, a thickened, friable wall will not collapse.

In beginning the dissection, the gall bladder is held in the left hand, and an incision is made through the peritoneum along the right side near its liver attachment. This incision through the peritoneum starts usually just above the pelvis and extends for about 2 inches along the body of the gall bladder parallel to the liver margin (Fig. 7, a). By

lifting the gall bladder, and rotating it to the left, a line of cleavage is easily formed posteriorly. Following this line of cleavage, the gall bladder is separated from the liver or connective-tissue bed in this particular region. The separation may be done with the finger, or it may be done by inserting and spreading a blunt hæmostat, at the same time lifting up and rotating the gall bladder to the left. Where the tissues are œdematous and the gall bladder thickened and friable, the tissues separate very readily.

After freeing the posterior wall of the gall bladder in this region, it is partially rotated out of this opening and peeled away from its left peritoneal fold (Fig. 7, b). The chief branches of the cystic artery pass in this left peritoneal fold near the neck of the gall bladder. Some branches may be ligated when an opening is now made in this freed fold of peritoneum on the left side of the gall bladder. If possible, a flap of the peritoneum, one-half to three-fourths of an inch wide, is left attached to the liver. This frees a small portion of the gall bladder just above the neck entirely from the liver. The opening permits easier manipulation of the gall bladder for further posterior dissection toward the cystic duct.

There have been several variations used in the technique of freeing the left peritoneal fold in the region above the gall-bladder neck and ligating the branches of the cystic artery, due to variations in the anatomy. Where the cystic artery branches off well above the gall-bladder neck, the larger branches may be ligated in cutting an opening through the left peritoneal fold. But where it is avascular it may be perforated by a blunt hæmostat, which is spread apart and the opening enlarged. The branches of the cystic artery which pass in the peritoneum over this region of the neck, may be ligated separately or with the mesentery after enucleating the cystic duct. Where dissection of the gall bladder posteriorly and below may be done easily by rotating it, the entire left peritoneal fold may be left intact until after the dissection of the cystic duct.

After freeing that portion of the gall bladder in the region above the neck it is lifted up and rotated away from the right side. This exposes the lower uncut portion of the right peritoneal attachment which extends over the pelvis of the gall bladder. The lower portion of the gall bladder and pelvis are first separated from their posterior liver or connective-tissue bed from above by blunt dissection and the right peritoneal fold is then cut as the dissection is carried down. The neck of the gall bladder is followed posteriorly to the cystic duct, which is approached from above by traction on the gall bladder, and rotation to the left which exposes the posterior wall. The posterior attachments of the lower end of the gall bladder and cystic duct are usually formed by loose connective tissue, making separation easy. This dissection gives full view of the posterior neck of the gall bladder and the cystic duct.

The anterior peritoneal folds are intact below in the region of the blood vessels and

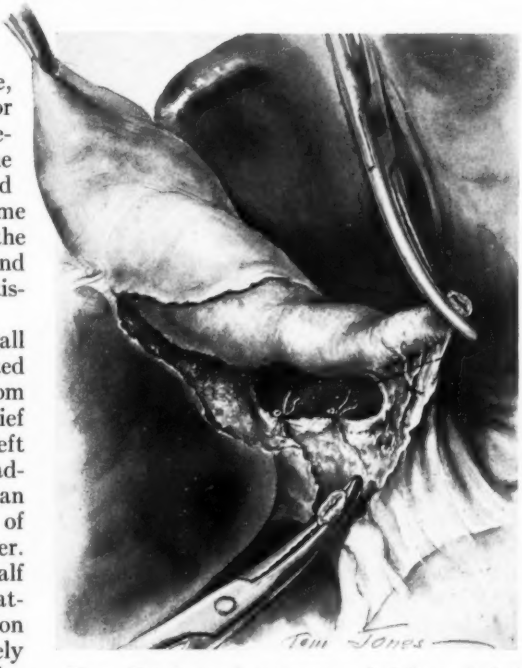

Fig. 9. Traction on the cut upper end of the cystic duct exposes the uncut portion of the left peritoneal attachment to the neck of the gall bladder which contains branches of the cystic artery. This peritoneal fold and the cystic artery branches are ligated distally, well out of the danger zone. The peritoneal attachment is cut through, along the dotted line, freeing the lower end of the gall bladder.

bile ducts. Consequently, if adhesions or anomalies are present, they may be left undisturbed. The cystic duct is enucleated from the lower portion of the left and anterior peritoneal fold. This may be done by means of blunt dissection with a curved hæmostat, while the gall bladder is held forward and rotated to the left, exposing the posterior structures (Fig. 8). The cystic duct is now freed as far down as is desired, double clamped and cut. Traction upward upon the clamp attached to the cystic stump will partially enucleate the lower end and neck of the gall bladder from this left peritoneal fold. With rotation to the left of the neck of the gall bladder and this partial enucleation of the cut cystic duct, there is formed quite a distinct, uncut fold of peritoneum on the left at the lower end of the gall bladder (Fig. 9).

This fold of peritoneum, which usually contains the chief branches of the cystic artery may now be caught with one or two hæmostats close to the gall-bladder neck and either double ligated or a transfixion ligature used. The distal ligation of the branches of the cystic artery in this manner makes it unnecessary to dissect out the main artery in the danger zone. Section of this band of peritoneum near the gall bladder entirely frees its lower end. If a hæmostat or ligature slips, this mesentery containing the branches of the cystic artery is long enough and far enough away from the danger zone so that it may be picked up again without injury to any vital structures.

There is no danger of injuring the hepatic or common bile ducts or abnormal structures because the gall-bladder neck is first exposed, and this is followed down posteriorly along the cystic duct, by lifting the lower end of the gall bladder, and rotating it to the left. During the dissection, traction may be made on the still attached fundus, the freed circumference of the gall bladder, and later upon the stump of the cystic duct in order to give better exposure and to assist in the separation. After the lower end of the gall bladder is freed, the upper part of the body and fundus are separated from below up. From my observations, the large and chief anastomosing branches from the liver are usually in this upper region. A flap of peritoneum may be left at the liver margin, in order to cover the raw surfaces of the liver.

ADVANTAGES

There are several advantages in this lateral posterior approach, followed by posterior dissection of the gall bladder, first toward the neck:

1. There is a lessened danger of injury to the bile ducts. This also obtains in the presence of variations in anatomy and in difficult cases with pathological changes, due to the complete and easier dissection of the gall bladder posteriorly down to the duct.
2. There is less danger of injury to the blood vessels going to the liver.
3. The cystic artery is ligated peripherally at its branches. An escaped branch of the artery will not retract into the danger zone and may easily be picked up.
4. There is a dry field.
5. The dangers from hæmorrhage by a torn cystic artery and injury of the bile ducts from hurriedly applied hæmostats are avoided.
6. The gall bladder is under complete control.
7. Aside from the safety of this method of gall-bladder removal, I find it easier mechanically than any other method.

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INTESTINAL RESECTION IN MASSIVE UMBILICAL HERNIA[1]

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THERE are few conditions that appear more hopeless than certain of the enormous, irreducible umbilical hernias that occasionally come under the surgeon's observation. Coley has said that "The large umbilical hernia in the adult is one of the most difficult of all varieties of hernia to treat, and its proper handling requires the exercise of the greatest judgment." Whether we should operate on the large hernia of this type, containing most of the omentum with many loops of the intestine bound together by numerous adhesions, is a question on which opinions still differ. Until very recently we have been advised against operating in such cases, on the ground that the mortality is necessarily great and that recurrence is the rule.

In the section on hernia in Keen's *Surgery* is depicted a large umbilical hernia that is considered inoperable and yet is no larger than several that have recently been treated successfully by surgical operation.

In a series of 433 cases of hernia that have come under my observation in the past 6 years, 28 have been umbilical, and 5 of these might readily have been considered inoperable. Recently a patient with an enormous, irreducible umbilical hernia of 25 years' duration came to the hospital, suffering from acute obstruction. An extensive intestinal resection seemed the only solution. The prompt and satisfactory result that was obtained following an excision of the omentum, cæcum, and ascending and transverse colons with 7 feet of the ileum, lead to the adoption of free intestinal resection in several subsequent cases that presented technical difficulties of similar proportions.

Three such patients have been operated on recently and all have recovered so satisfactorily that I have been encouraged to seek others with like conditions of seeming inoperability.

CASE 1. Miss. S. D., age 67, was admitted to the hospital December 30, 1921. She had excellent health until the age of 45 when she was in a hospital for several weeks suffering from influenza which, she reports, seemed to "settle in her lungs" and was attended by paroxysms of exhausting, non-productive cough. From this time she had had "chest colds" every winter with severe cough lasting usually 6 to 8 weeks. The patient attributes her hernia to the strain incident to the first attack of coughing at the age of 45. She first noticed a small bulging at the umbilicus which gradually increased in size, due to the strain of subsequent coughing, until the hernia attained its present gigantic proportions. With the onset of the hernia 22 years before came attacks of "indigestion." As described by the patient, there

[1] Read at the fourth annual meeting of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic, Rochester, Minnesota May 30, 1922.

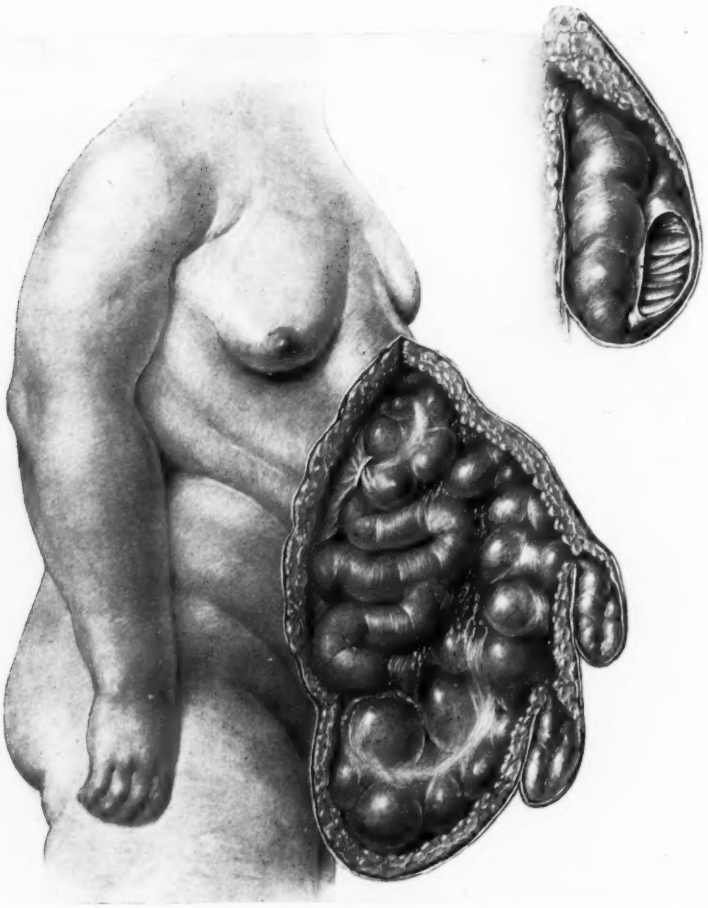

Fig. 1. Case 1, Miss. S. D. Enormous irreducible umbilical hernia of 25 years' standing with acute intestinal obstruction. Insert shows loop of ileum in secondary loculus with obstruction resulting from angulation and the impaction of several prune stones.

seemed to be an area of pain in the region of the umbilicus which ascended to the stomach and caused severe epigastric distress. In the course of a few years these attacks became more frequent and more severe occurring every 2 or 3 months, and were attended by vomiting. The present attack began 5 days ago with severe pain in the abdomen and with obstinate constipation. Enemata and cathartics were ineffectual. Three days before, patient began vomiting, first, the contents of the stomach and then fæcal material; this had persisted almost continuously.

On physical examination a huge hernia was found, extending from the ensiform cartilage to midway between the umbilicus and symphysis pubis. The hernial mass protruded about 50 centimeters from the anterior abdominal wall and consisted apparently of three lobes, all contained in the hernial sac and covered by skin and varying thicknesses of superficial fat. There were several areas of tympanitic resonance, which contained bowel distended with gas, while flatness on percussion was elicited in other areas and were firm to the touch. The hernia was roughly 60 centimeters in breadth and it appeared to be strangulated.

The transverse and ascending colon, cæcum, and about 280 centimeters of ileum were resected and end-to-end ileocolostomy performed. Examination of the specimen revealed a collection of seven prune

stones packed in a loop of ileum and causing complete obstruction.

Two days after the operation, the patient developed an intense diarrhœa. The stools were liquid, light brown in color, and contained proteolytic ferments of the pancreas and intestine, as they produced a marked digestive action on the buttocks. From the third to the twelfth day, stools became more frequent and involuntary, averaging 20 in 24 hours. On the twelfth day, rice gruel (10 per cent) was added to the general diet. Sixteen ounces were given every 24 hours for about 5 days. The constipating effect of rice and boiled milk undoubtedly exerted a slight influence in checking the diarrhœa, since from this time on the patient had fewer bowel movements, they were of greater consistency and the control was better. At the time the patient was dismissed, the stools were still liquid, averaging two in 24 hours. Coarse vegetables and fruits were found unchanged in the stools, particularly green and partially cooked vegetables. From time to time spinach, celery, lettuce, carrots, corn, and beans cooked in vegetable soup were found in the stools unchanged. Bread and stewed or boiled meats and well cooked vegetables containing no cellulose, for example, mashed potatoes, were all well digested. The patient was fond of milk and this was the mainstay of her diet while she was in the hospital.

The patient gradually improved for 3 months. Her two meals daily consisted mainly of milk, bread and butter or jelly, potatoes and macaroni. She ate very little meat after her operation and said that she had lost her taste for it. She had two attacks of severe, transient pain in the epigastrium and one attack of severe diarrhœa after drinking of iced ginger ale. Her bowel movements were still liquid, averaging two or three in 24 hours. She lost nearly 100 pounds in weight, but did not feel especially weak. She possessed an excellent appetite and thoroughly enjoyed her meals. In June, she resumed her occupation as a hand ironer in a public laundry.

CASE 2. Mrs. A. B., age 38, was admitted to the hospital December 26, 1921. Fourteen years before the patient had a difficult labor, with her third child, and she believed the present trouble resulted from straining at that time. Twelve years before, she noticed a mass protruding from the umbilicus immediately after the birth of her fourth child. This condition became progressively worse until the umbilical hernia was about 40 centimeters in diameter and 20 centimeters in depth. Recently the mass had caused almost constant pain and had become irreducible. Bowels had been markedly constipated.

The patient was a very obese woman, not acutely ill, but apparently very uncomfortable from a large, irreducible umbilical hernia. The abdomen was pendulous, and there was no tenderness over the region of the appendix or gall bladder. The liver and spleen were not palpable. In the umbilical region was a large protruding mass, regularly oval

Fig. 2. Irreducible umbilical hernia. Skin incision for the isolation and resection of sac contents. Skin within lines resected.

in outline about 40 centimeters in diameter, and firm and resistant to the touch. In the lower portion of the hernia could be felt a hard tumor, rather freely movable and possibly attached to the uterus. Examination of the pelvis did not furnish information of value because of the patient's marked obesity.

December 28, the patient was admitted to the hospital for operation. The temperature was 100°, and analysis of the urine revealed a severe nephritis. Test of the renal function showed 30 per cent phthalein return in 2 hours. The leucocytes were 12,050 and the polynuclears 89 per cent. The Wassermann reaction of the blood was negative. Operation was postponed until the temperature had been normal for 8 days and the urine clear.

At operation, January 6, 6 feet of ileum with the cæcum and ascending colon were resected, and an end-to-end ileocolostomy was performed. One drainage tube was inserted beneath the skin to take care of fat necrosis. Examination of the specimen revealed that the mass that was believed uterine, was a dense area of reactive inflammation about an old suppurative appendicitis.

On the second day of convalescence the patient vomited and on gastric lavage a large amount of foul, yellow fluid was returned. The seventh day the patient was placed on a soft diet as nausea had

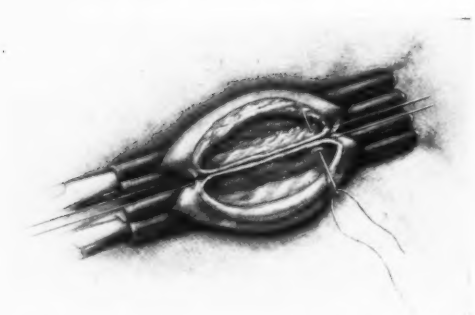

Fig. 3. The ileocolostomy. The ileum and colon approximated. Traction sutures in place. First stitch of posterior mucous suture line.

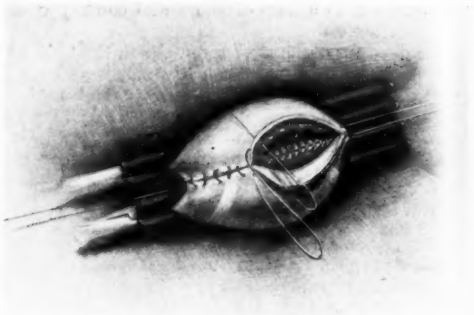

Fig. 4. Posterior suture line completed, anterior margins being inverted and serosa approximated. The operation is completed by a circle of interrupted silk suture through serosa.

entirely subsided. She developed a severe diarrhœa on the twentieth day and in addition to light, soft diet 10 per cent rice gruel was given with boiled milk and camphorated tincture of opium, 1 dram for four doses.

By the thirtieth day the patient's temperature was normal, and she was permitted out of bed. Her appetite was good and the diet was gradually increased. Bowel movements were still rather frequent.

On dismissal, February 10, the patient still had some trouble from "indigestion" with slight vomiting at times, especially on awakening in the morning. The wound had healed firmly. May 18, 1922, the patient returned for examination. She was doing much of her housework. The bowels moved two to three times a day. The appetite and digestion were very good though the patient had lost nearly 100 pounds in weight. She slept well, had no pain but some pruritis. There was a definite hernial defect on coughing, but the protuberance was readily supported by a binder. The question of radical herniorrhaphy was left to be considered at a subsequent examination in 3 months.

CASE 3. Mrs. A. E., age 52, was admitted to the hospital, March 20, 1922. For 35 years the patient had been gradually gaining in weight. The abdomen had become more pendulous with each of thirteen childbirths. The condition had been aggravated since instrumental delivery 8 years before. During the past 2 years, the patient had been able to be on her feet for but a very short time, owing to the strain incident to supporting an enormous ventral hernia.

There had not been much pain in the abdomen: the bowels had never been loose but rather had been constipated and had moved only with the aid of cathartics. The appetite had always been good. For 2 years there had been nocturia two to three times, and at times urgency, especially when standing. The patient had an enormous pendulous abdomen. There was no definite hernial ring, but there was a wide diastasis of the rectus muscles with extrusion of the viscera and marked thinning of the abdominal walls.

At operation an intestinal resection was performed for wide rectus diastasis with large ventral hernia. Resection included the mesentery, cæcum, ascending colon, and a portion of the transverse colon, and about 2 feet of the ileum. Ileocolostomy was performed with end-to-end anastomosis. The weight of mass removed amounted to 1680 grams.

Four days after operation the patient developed a slight diarrhœa, but apart from being liquid, the stools were not abnormal. The number each day ranged from one to five. After the twenty-third day the stools averaged one daily. Occasionally the patient complained of discomfort after eating but this was relieved by sodium bicarbonate. The wound had entirely healed and the abdomen was readily supported by a binder. The patient was discharged from the hospital 35 days following the operation.

The easy confidence with which widespread intestinal resection can be carried out was demonstrated by Lane a few years ago when the operation was being popularly exploited in the treatment of so called intestinal stasis. Many very extensive intestinal resections are recorded in the literature and as one delves into the surgical archives he finds records of more and more widespread excision. There are instances of 2, then 3 or 4 feet of intestine removed and on to 5, 6, 7, 8, 10, and even 13 feet, until one is led to expect that he may ultimately unearth the records of some especially venturesome surgeon who has succeeded in anastomosing the pharynx directly to the anus. Littlefield has written of massive resections in postoperative

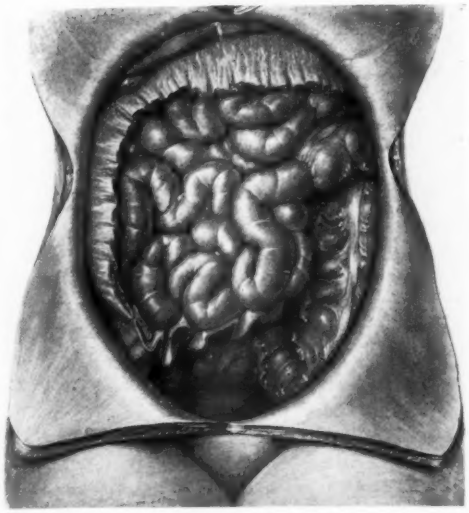

Fig. 5. Schematic drawing showing hernial mass resected and the ileocolostomy completed.

intestinal obstruction while Dunlap, Sherrill, Southam and Cranshaw record their experi-

TABLE I.—RESECTION OF ILEUM

Operator	Length of section resected, centimeters	Part resected	Result
Reder*	204	Ileum	Recovery
Dressmann (1899)	215	Ileum	Recovery
Shepherd (1898)	234	Ileum	Recovery
Kukula (1900)	237	Ileum	Recovery
Harris (1902)	239	Ileum	Recovery
Kirkwood (1915)	240	Intestine (Part of ileum)	Recovery
Payr (1902)	265	Ileum	Recovery
Zeidler (1906)	318	Ileum	Recovery
Miyake (1912)	238	Intestine (225 cm. ileum and 13 cm. colon)	Recovery
Long*	360	Ileum	Death
Obalinsky (1894)	365	Ileum and cæcum	Death in 28 hours
Turck (1914)	371	Ileum and colon	Recovery
Haggard*	380	Ileum and colon	Death in 11 days
Pauchet (1905)	400	Ileum	Recovery
Storp (1907)	510	Small intestine (Entire ileum and part of jejunum)	
Brenner (1910)	540	Intestine	Recovery

*Personal communication.

Fig. 6. Typical mass excised in irreducible umbilical hernia.

ences in resections in intussusception. Wood, of Edinburgh, recently reported a case of extensive resection of the ileum in a case of strangulated umbilical hernia. It has been generally agreed that at least one-third of the small intestine may be removed and the patient survive and remain in a fair state of health. Both Park and Moynihan have collected all reported cases of extensive resections of the intestine, but the total number is not large. There are in the literature approximately 48 cases of excision of very large portions of the ileum, the greatest being a removal of 540 centimeters by Brenner in 1910. A table of cases taken in part from Park and Moynihan and other sources dealing with resections of the ileum, is appended (Table I).

Operations upon patients with massive, irreducible umbilical hernias of many years' standing are among the most difficult. The condition is usually found in stout women of advanced years, who have borne many children and who often suffer from advanced cardiorenal disease. The repeated trauma-

tism, to which the bowel has been subjected during its sojourn of many years outside the abdomen, results in the formation of the densest sort of adhesions between the numerous loops of bowel and between them and the walls of the sac. The latter, usually multiloculated in an indescribably complex manner, often contain all of the colon, with the omentum, many feet of the ileum, and occasionally the stomach. Strangulation often occurs as a most grave complication.

The extensive and intricate dissection necessary to the complete isolation of the contents of the hernial sac from the margin of the abdominal defect through which the hernial elements protrude, with the ultimate resection and anastomosis, carries the operation well into the second hour and often into the third. The extreme care that must be exercised that the bowel, which in many instances is of tissue paper thinness, is not damaged during the dissection, often renders the procedure extremely tedious. The startling display of many feet of bowel, with its fat-laden mesentery and omentum often requiring the combined efforts of several assistants to prevent the prodigious mass from falling to the floor and dragging the patient with it, renders the scene somewhat ghastly and not unlike that presented in the average necropsy room.

Obviously every means at our disposal must be utilized in supporting the patient's vital forces during so formidable a procedure. The operation must proceed smoothly but without delay and the surgical personnel must carry on with that perfect team work that is now required in all well organized operating rooms. Great care must be observed during the division of the bowel that asepsis is maintained, the intestine being opened with the cautery and the anastomosis being performed with the thoroughness necessary positively to preclude subsequent leakage. The operation is preferably performed on a heated table while salt solution is administered freely before, perhaps during, and following the operation.

Should the patient's condition, especially at the end of a very extensive resection, contraindicate further surgery, closure of the hernia is left for a subsequent operation, the umbilical defect being temporarily closed with interrupted silk. Whether herniorrhaphy be performed at once or is reserved for a second operation, the closure is best effected according to the Mayo method which has so satisfactorily stood the test of time.

In the usual case of umbilical hernia the bowel can readily be returned to the abdomen after all adhesions have been freed. However, we are at present concerned with the hopelessly irreducible, massive hernia of many years' standing, often with partial or complete obstruction in which the intestine has sojourned outside of the abdominal cavity for so great a time as to have long since "forfeited its right of domain."

In operating on these cases I have been surprised at the slight shock such formidable procedures seem to produce. In the first case I looked aghast at the result of my work, especially when I saw two nurses leaving the operating room struggling with the weight of a large bucket containing most of the patient's colon, all of her omentum and about one-third of her ileum, and I felt that with so much of an important structure removed, it was somewhat of a question as to which object was entitled to the greater solicitude, the patient on the table or the contents of the bucket.

The bowel's long residence outside the abdomen proper, subjected as it is to repeated and unavoidable trauma, with the many years of constantly increasing traction upon the mesentery, apparently so inures the splanchnic system that the rough usage to which the intestine is necessarily subjected during the operation produces surprisingly little change in the patient's blood pressure.

I desire to emphasize the importance of carefully closing the hiatus in the mesentery on the completion of the anastomosis. Axial union between resection of divided bowel is, obviously, the ideal method of anastomosis and I feel that the general attitude of surgeons against end-to-end anastomosis between colon and ileum is not fully warranted. This is but an endorsement of Balfour who pleads for the end-to-end union rather than the lateral approximation, and I have followed

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7. Front view of patient who had suffered with large irreducible umbilical hernia with rectus diastasis which had been present more than 20 years.

Fig. 8. Lateral view of patient shown in Figure 7.

Fig. 9. Patient with irreducible umbilical hernia of 10 years' standing. Had previously been operated upon twice.

the technique of Lockhart-Mummery in the present series as well as in other cases of resection for obstruction and malignancy, with most satisfactory results.

My patients have reacted promptly from operation and by the third day seem in better general condition than the average person upon whom a cholecystectomy or hysterectomy has been performed. There is usually an annoying diarrhœa during the first few weeks; but this gradually subsides although the patient may continue indefinitely to have two or three stools a day. Except for this trouble, the patient seems but little worse for the loss of such a large fraction of her alimentary tract while the relief afforded by the removal of the great pendulous mass, which in one of my cases was so great that the patient was unable to walk, is very great and far offsets any annoyance resulting from the diarrhœa.

The small intestine, from the opening of the common duct, is derived from the mid-gut and from it is absorbed 90 per cent of the solids and over 50 per cent of the fluids of the intestinal tract. The colon to the splenic flexure, also derived from the mid-gut, takes up the remaining 10 per cent of solids and the rest of the fluids.

The loss of so large a segment of the absorbing portion of the alimentary tract in the removal of the ascending colon, and particularly if the resection extends far into the ileum, necessarily results in marked metabolic disturbances chiefly manifested by rapid and pronounced loss in weight. With my patients, this has occurred, amounting in one instance to nearly 100 pounds. However, as these patients are, as a rule, very obese the loss is something of an advantage. At least the patient's strength is maintained, the appetite and digestion remain excellent and,

except for the diarrhœa, the patient presents a picture of comfort and well-being in striking contrast to the ill health exhibited before being operated upon.

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DEPARTMENT OF TECHNIQUE

ASEPTIC RESECTION OF INTESTINE[1]

By E. D. HIGHSMITH, M.D., F.A.C.S., Atlanta, Georgia

ONE of the most baffling problems in intestinal surgery is the devising of a technique which will make it possible to do an end-to-end anastomosis which will not be followed by infection. Infection in intestinal surgery is caused usually by contamination from the contents of the bowel after it has been opened, and it is especially likely to occur after operations on the colon. To overcome infection—a matter of prime importance in such work—various methods of procedure have been used; the lateral intestinal anastomosis on the large bowel, the end-to-end anastomosis on the small bowel.

I think that it is generally admitted that a lateral anastomosis is physiologically and mechanically bad surgery, as the circular muscles of the intestine are cut and the ends overlapped and suturred together, thus producing a sort of splint which practically destroys peristalsis in this region. At the site of an end-to-end intestinal anastomosis, there is not the slightest stasis; while in a lateral anastomosis a blind pouch which cannot be emptied is left at either end of the overlapped area. The lateral anastomosis is therefore used not for its physiological advantage, but because most of the operation can be completed before the lumen of the bowel is opened, thereby lessening to some extent the dangers of contaminating the field of operation. However, lateral anastomosis is essentially an open operation, and therefore if it is possible to do an end-to-end anastomosis of either the large or small intestine with less danger of infection and in a shorter period of time, and to restore the parts nearer to the physiological normal, why should one resort to lateral anastomosis?

Last year in the department of experimental surgery of Emory University, a number of experiments in intestinal anastomosis were performed on dogs under general anæsthesia. The loop-clamp was devised which makes it possible

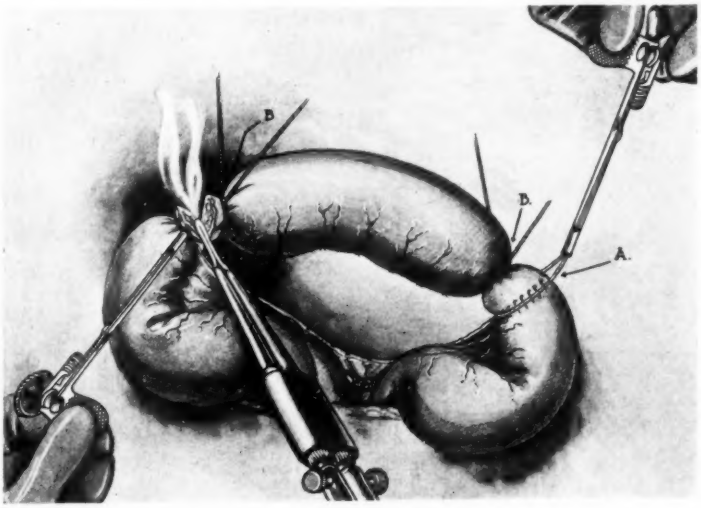

Fig. 1.

[1] Submitted for publication, September, 1922.

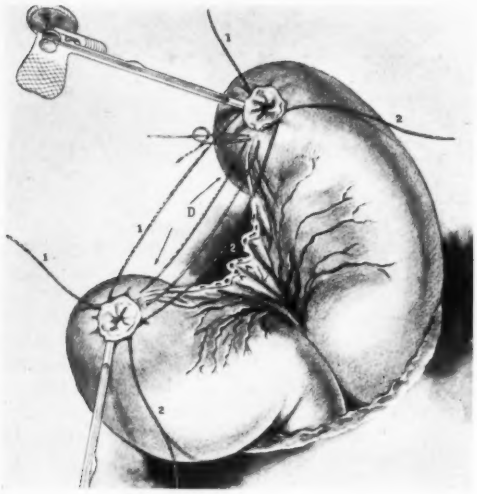

Fig. 2.

to do a blind end-to-end intestinal anastomosis. With this instrument, it is possible to hold the intestine closed while the diseased area is cut away by the cautery, the ends sutured together, and the operation practically completed before the clamp is released and the ligature slipped out. By the aid of traction sutures Figures 1, 2 and 3, the double diaphragm is pulled open.

TECHNIQUE

The usual method of tying off the blood supply and freeing the intestine to be removed from its

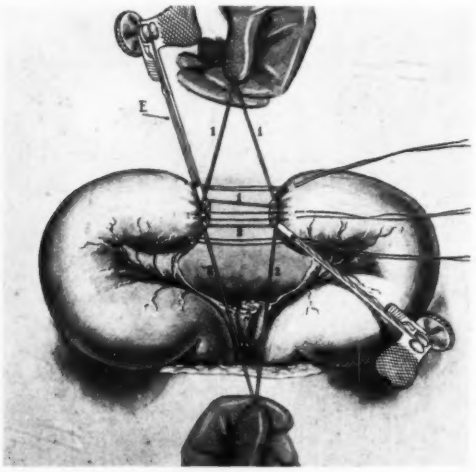

Fig. 3.

Fig. 4.

mesenteric attachment is carried out. The intestine to be removed is crushed at each end with a thin serrated forceps, and a strand of large silkworm gut, plain catgut, or a small flexible wire is thrown around the intestine at the crushed area and threaded in the loop-clamp in such a way that a clamp can be held in each hand of the assistant, and the intestine held in ap-

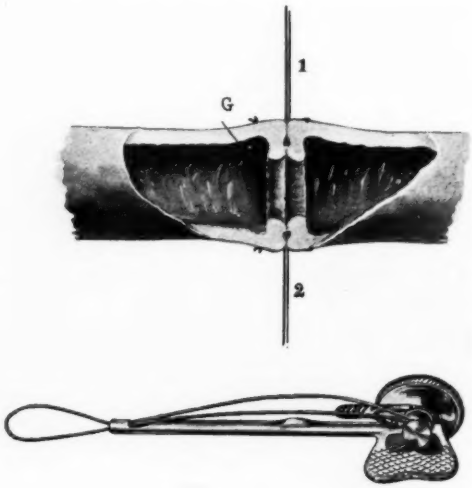

Fig. 5.

position by the instrument, as it were, so the assistant will not be in the way of the operator, and by the aid of the ratchet the gut or wire is drawn taut around the intestine at this area, as shown in Figure 1, *A*. A ligature is tied tight around the intestine about three-quarters of an inch to the inner side of each clamp to hold the contents of the segment to be removed, as shown in Figure 1, *B*. With the cautery the intestine is then severed between each clamp and ligature, which renders each end sterile as shown in Figure 1, *C*. (This can be done with the knife and treated with carbolic acid and alcohol in the absence of the cautery.) The first mattress stitch is then put in at the mesenteric formation of the intestine, care being used to incorporate each fold of the mesentery in this stitch so as to prevent a leak and to insure the blood supply to the walls of the intestine, as shown in Figure 2, *D*. A mattress stitch is then placed on each side of the first stitch, and the assistant holds the two ends in apposition by the handle of the clamp, as shown in Figure 3, *E*, while the traction sutures *1* and *2* in Figure 4 are put in each side of the intestine as shown in Figure 5, *G*.

The anastomosis is finished and care is used to insert the sutures close to the loop-clamp so that too much intestinal wall will not be turned in. Quite often it is necessary to put in a few Lembert sutures to insure perfect coaptation of the intestinal walls. After the sutures have been tied, the silkworm gut loop is cut as shown in Figure 4, *F*, and the strand of silkworm gut pulled out. If plain catgut is used in the loop-clamp it may be cut close and allowed to remain in, as it will fall in the lumen of the intestine after it has been freed. Traction is exerted on traction sutures *1* and *2*, which will pull open the double diaphragm; otherwise it might be held sealed by the action of the cautery. The traction sutures may be pulled out or cut close and Lembert sutures placed over them, as it has been passed through the serous and muscular coats of the intestine between the crushed area and the cauterized end of the intestine.

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A NEW TECHNIQUE FOR POSTERIOR GASTRO-ENTEROSTOMY

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DURING the last decade the small forceps formerly used to hold the stomach and jejunum in apposition in performing gastro-enterostomy have been supplanted by various types of clamps which make the operation difficult for those unused to them. It is not my object to enter into a discussion of the advantages of different types of clamps, but to present a modification of the usual technique, which simplifies the operation. I have abandoned the use of clamps, for I believe they are of no real value and that they sometimes traumatize the visceral walls.

In the technique which I have devised two guide sutures are placed 7 centimeters apart to fix the stomach and jejunum (*I*, *II*, Fig. 1). This will permit an opening of approximately 5 centimeters. I first suture the serous surfaces, using a straight needle which is passed from left to right, and then suture the stomach to the mesocolon (Fig. 1). I then remove the guide suture (*II*, Fig. 1) and, with forceps passed underneath the jejunum through the opening in the mesocolon (Fig. 1.), grasp the serous suture and the remaining guide suture (*I*, Fig. 1) and draw them through the opening in the mesocolon. After turning the jejunum to the left side of the patient so that the line of sutures described lies posteriorly, I open the stomach and jejunum, clamp the blood vessels and resect any excess mucous membrane. I

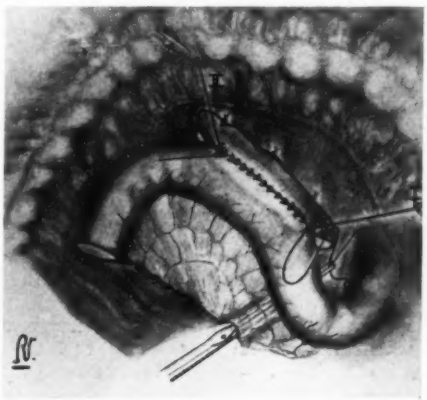

Fig. 1.

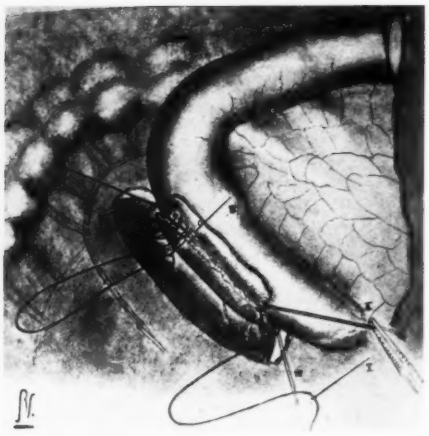

Fig. 2.

begin the suture of the mucous membrane on the left side, maintaining tension on the layers to be sutured. After completing the suture of the posterior layer of the mucous membrane I begin again at the left and insert the anterior layer of sutures. In completing the anterior layer I bring the inferior angle of the anastomosis into plain sight by exerting tension upon this point. I then complete the serous suture and with a few interrupted sutures close the opening in the mesocolon.

This method makes it possible to keep in plain sight constantly those portions of the bowel which are to be united. Because the opening in the jejunum is made opposite the mesenteric attachment (Fig. 3) and not near it (Fig. 4), as sometimes happens when clamps are used, the blood supply of the bowel is well maintained. Since there are no clamps in the way the surgeon has better access to the margins of the opening in the bowel and stomach, and it is possible to make the opening of the size which he considers advisable.

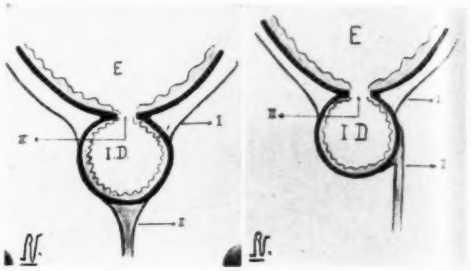

Fig. 3. Fig. 4.

Technical errors which may arise from the use of clamps are torsion of the fixed gut in its longitudinal axis, improper orientation of the line of anastomosis, interference with the blood supply, and incomplete hæmostasis. As a result there may be dilatation of the stomach, vomiting, hæmatemesis and jejunopeptic ulcers.

The technique which I propose differs from the usual technique in that clamps are not employed, and that after inserting the first line of serous sutures the jejunum is turned from the right to the left side of the patient. I have performed this operation eight times, and am well satisfied with the results obtained.

A NEW METHOD OF MAKING URETEROPYELOGRAMS

By NATHAN P. SEARS, Ph.B., M.D., Syracuse, New York

DURING the past few years the kidney and ureter have been recognized as taking a prominent place among the causes of vague abdominal pain. Many times definite conditions which might have been discovered by careful physical examination and history, and the usual method of cystoscopy, have been overlooked.

However, there is still an appreciable number of patients with vague, persistent abdominal pain, which simulates renal and ureteral colic, for which no apparent cause exists when the patient is examined by our usual methods. Hunner has called attention to stricture as demonstrated by wax bulb method. Kinks and strictures are seen at times by the usual methods of ureteropyelography, but it seems to the writer that ureteropyelograms taken with the ureter in its uninvaded state would give more definite information. P. E. McGowan in the *American Journal of Urology*, vol. iv, discussing paper of Crabtree and Sheddon, states that he is making such study. Goldstein has used fluoroscopy, taking pyelograms with catheter at various levels.

The following technique is simple and has the advantage of filling the ureter from below, without having first disturbed its natural course by passing the catheter, and also prevents the reflux of solution about the catheter.

TECHNIQUE

A wax spindle about 2.5 to 3 millimeters in diameter is placed on the whistle tip catheter about 1 to 1.5 centimeters from the tip. The catheter is threaded back through the cystoscope in the usual way of passing wax tips (described by Harris and also by Hinman). The instrument is then introduced, the catheter with the bulb is passed into the ureter to be studied so that the bladder wall holds the bulb. This permits the tip of the whistle tip catheter to enter the ureter. The other side is catheterized and urine collected from each for study. The patient's shoulders are elevated slightly and a 14 by 17 X-ray plate is placed under the back so that it inclines downward at an angle of about 10 to 15 degrees. The ureter and pelvis are then gently filled in the usual manner.

If the patient is flat on his back the upper ureter does not fill, probably due to the fact that the fluid, after crossing the iliac crest, flows rapidly to the pelvis and produces the pain of distention, prohibiting further injection. The Tren-

Fig. 1. Normal ureter and pelvis, low kidney.

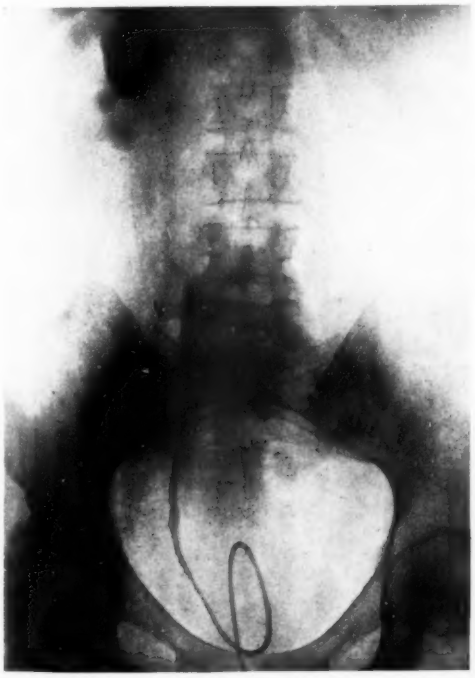

Fig. 2. Constriction of broad ligament portion of ureter due to advanced cervical carcinoma.

Fig. 3. Marked ptosis kidney, numerous kinks in ureter.

delenburg position permits the kidney to fall upward and thus disturbs its casual position and does not give true information. After the picture is taken the catheter may be passed up, or, if the bulb interferes, another catheter passed in place of the opposite one, which can be removed, is passed to drain the fluid. However, the fluid usually flows back more quickly with the catheter low in the ureter than with the other method.

By this technique accurate information regarding stricture or kink can be obtained and obscure causes of pain located.

I will reserve discussion of the interpretation of these findings and their clinical significance for another paper.

FURTHER OBSERVATION OF HEART MASSAGE AS A FINAL RESORT FOR RESUSCITATING HEARTS FAILING UNDER GENERAL ANÆSTHESIA

By T. C. BOST, M.D., Charlotte, North Carolina

THE expression, heart massage, in its surgical meaning implies intermittent compression or kneading of the organ and has for its object the re-establishment of cardiac action which has failed, as during the progress of a surgical operation or while the patient is under the influence of a general anæsthetic.

A word as to the physiology of the heart might not be out of place, and in this connection the question might naturally arise, Why does the heart stop? It is equally pertinent to ask, Why does the heart beat? The prevailing opinion leans toward the myogenic theory, which holds contractility to be an inherent function of the cardiac muscle and the one fact that stands out pre-eminently is that the greatest rhythmic power resides in the basal portion of the heart, that is, in what corresponds in the more primitive hearts to the sinus venosus.

From a surgical standpoint, the failure of the heart in the majority of instances may be accounted for by reflex vagus inhibition and the action of the toxines from the anæsthetic and other sources directly upon the heart muscle.

Heart massage according to Keen, D'Halluin and, recently, Gunn favors resuscitation by: (a) depletion—emptying mechanically the cardiac chambers; (b) by a mechanical irritant, stimulating the reserve energy of the cardiac muscle; (c) creating an artificial circulation which keeps up the nutrition of the myocardium, and supplies fresh blood to the brain. Physiologists have put great emphasis on the value of artificial circulation. Of these, may be mentioned Gunn, who injected a dye in a peripheral vein and detected it in a peripheral artery after a few compressions of an arrested heart, thus establishing its value. Zezas attributes to the artificial circulation the success of heart massage.

Massage, as a practical means of treatment in cases of failure of the pulse and respiration, especially those occurring during general anæsthesia, is based not only upon a series of physiological experiments, but upon clinical evidence as well.

The experiments began with the work of Schiff in 1874. He showed by chloroforming a number of dogs until the heart ceased to beat that artificial respiration and stimulation by electricity were of no avail, but that massage directly applied restored cardiac action after an interval of 11½ minutes. Tuffier and Hallion communicated a similar series confirming this work. In 1900 Prus published the results of experiments performed by him on 100 dogs, killed by electricity, by suffocation, and by administration of chloroform. Heart massage and artificial respiration were started in periods varying from 55 seconds to 1 hour. Of those in which the heart was arrested by electricity, massage was successful in 14 per cent; while in the others, over 75 per cent were resuscitated. Prus concludes that life can be induced to return even after the heart has ceased to beat for 1 hour. Provost and Balleti from results in animal experimentation concluded that fibrillary twitchings of the heart muscle were the greatest bar to successful massage, and showed that the longer the time which elapsed between the stoppage of the heart and the beginning of the massage, the greater was the probability of these twitchings appearing. White, in 1909, was unable to restore either respiration or circulation by artificial respiration alone, even by inflating the lungs with a bellows

after the heart had ceased. The work of Crile and Dolley pointed out the fact that artificial respiration and cardiac massage should be carried out simultaneously.

This extraordinary power of the heart to regain its function after apparent death under certain physiological conditions is well known to the laboratory worker in the field of heart massage.

The first report of massage of the human heart was made in 1898 and the first successful case was as late as 1902 by Starling and Lane, so that as a therapeutic measure heart massage may be considered of fairly recent application.

Green reviewed the literature in 1906 and gave an abstract of 40 published cases. White collected an additional 10 in 1909, making a total of 50 cases.

I have searched the literature very carefully and have collected 25 more cases, making a total of 75, including the 2 here cited.

The methods employed have undergone considerable evolution:

1. *The thoracic route.* A flap of the thoracic wall over the cardiac area is cut and turned back. This procedure is necessarily forcible and must accentuate shock as many intercostal vessels and nerves are involved. Pneumothorax, too, has occurred in several of the published cases, and it is not surprising that the method has been abandoned, except in operations on the heart and lungs, in which a breach in the thoracic wall has already been made.

2. *The abdominal subdiaphragmatic route.* A median line epigastric incision is made and the right hand introduced below the diaphragm and the left placed over the cardiac area, interposing the heart between. This method has been most generally used, as it was a most natural thought when the heart action was arrested during the progress of a laparotomy, and when promptly done the conditions were favorable for resuscitation. It is the facility and the promptitude that secure success. It has been demonstrated, in a child, whose thorax is small and tissues elastic, that subdiaphragmatic compression of the heart is possible though difficult, but in the adult it would rarely be effective, in the obstinate case, as only the apex can be reached, making it impossible to empty the distended cardiac chambers or massage the base of the heart where the greatest rhythmic power resides. Thus the need for the transdiaphragmatic to reach the base, when this method fails.

3. *The abdominal transdiaphragmatic route.* In this method a median line epigastric incision is also made and the diaphragm is incised approximately anteroposterior, splitting the muscle fibers and gaining direct access to the pericardium. Contractions of the heart have been thus produced in practically all the cases however late applied; as, for example, Green's case, in which an hour after apparent death he incised the diaphragm and was able to produce a few contractions. While this method affords direct cardiac massage and is superior to the thoracic, yet it is objectionable in that it is a very difficult procedure. The stomach and left lobe of the liver handicap the incision of the diaphragm. There is also some risk of injury to the musculophrenic artery which may cause concealed hæmorrhage. Suturing of the opening in the pericardium and diaphragm is as difficult as it is necessary. Hence the advantage of the author's technique as worked out on a cadaver and applied in two cases.

4. *Author's method.* An abdominal incision is made in the median line extending well up to the ensiform cartilage. The left costal cartilages are well retracted, bringing the anterior diaphragmatic insertion well into view. A 2-inch incision beginning 1 inch to the left of the median line, carried outward behind the costal margin, cuts the fibers of the diaphragm near their insertion. The opening is rapidly dilated with two or three fingers of the right hand, so that the hand can be passed into the thoracic cavity, and the base of the heart effectively massaged. No vessels are injured in this incision, as the superior epigastric artery is to the inner side and the musculophrenic branch enters the diaphragm deeper than the incision. The liver and stomach, even if prominent, offer no obstruction to this route; nor is the pericardium in risk of being opened. During the massage the parts fit snugly around the wrist of the operator so that air is not sucked in, and there is no tendency to collapse of the lungs. The incision is easily closed and made airtight with a continuous catgut suture.

As to the technique for doing massage, it is pretty well agreed that this should be gentle compression of the heart at about half its normal rate to allow the heart to fill well, also this is in keeping with the rate at which the heart will start, which has been shown to be always slow. When the heart starts, massage should be stopped to allow it to regain tone and establish itself of its own accord, or at most only compressing the heart occasionally.

Mrs. H., age 38, mother of one child age 6, entered Presbyterian Hospital May 10, 1921, complaining of pain in lower abdomen of 5 years' duration, also irregular menstrual bleeding for past year. Examination revealed

slight local tenderness in lower abdomen and on pelvic examination uterus was irregular, about three times the normal size, and a small movable mass could be palpated on the right side. Physical examination of lungs and heart negative. Urinalysis negative. Blood: white blood cells, 8,500; red blood cells, 4,500,000; hæmoglobin, 85 per cent. Diagnosis: fibroid uterus, with a probable right ovarian cyst. Patient appeared otherwise normal and as a good surgical risk.

Operation May 11, 1921. Usual preliminary preparations with morphine ¼ grain and atropine 1/150 grain. Ether was administered and well taken. Hysterectomy was done for multiple fibroid uterus, also a right ovarian cyst and appendix were removed. The operation was finished and the peritoneum closed in 35 minutes, and at this stage head of table was elevated from Trendelenburg position and immediately patient ceased to breathe. Head of table was at once lowered and artificial respiration instituted. No pulsation could be felt, pupils dilated and insensitive. Atropine 1/100 grain and camphor in oil 3 grains were given. Drs. Ranson and Petteway could detect no heart sounds by auscultation. Several sharp percussion blows were made over cardiac area. After a lapse of 3 minutes the peritoneal sutures were removed and subdiaphragmatic massage done which caused a slight improvement in patient's color, but no heart beat or attempts at respiration. Extremities were bandaged and artificial respiration continued the whole time. Patient's expression changed to a waxy pallor and it was evident to all doctors and nurses present that patient's condition was hopeless. After a lapse of 6 minutes I proceeded to do direct heart massage by making an epigastric incision and incising the diaphragm, introduced my hand in the chest, and found the heart arrested in systole. I began gently squeezing the heart at about 25 or 30 times per minute. In a few seconds a reddish hue was observed in patient's color and in about one-half minute a slight muscular twitch was felt and then the heart began beating very feebly and slowly, but in a few seconds a radial pulse could be felt, after cardiac action had been suspended for approximately 7 minutes. Five minutes later spontaneous respiration began, not more than 3 or 4 per minute, but gradually improved. Oxygen and saline given. Incision closed. Patient returned to room in apparently good condition. Respiratory rate 20, pulse 100 with good volume. In about one-half hour patient began to react to a semiconscious condition, opened eyes, and attempted to speak, and moved about in bed. Several hours later pulse began to increase in rate and muscular twitchings developed in face and extremities; also pulse rate increased. Morphine and saline again given; also digifolin, but heart rate continued to increase, and it was soon evident that the patient was gradually losing and died, next morning, about 14 hours from time of resuscitation.

No autopsy was done, but in all probability nothing could have been found to account for this primary failure. The ultimate failure, after resuscitation, was in all probability due to the irreparable damage to the cortical cells during the suspended circulation.

This is a typical example of the cases, apparently good surgical risks, that suddenly pass out under general anæsthesia with no apparent reason.

This is my second case. The first was reported in the London *Lancet*, 1918.

Briefly, Pvt. B. had infected wounds which resulted in metastatic infection. He was given an anæsthetic and just as an incision was about to be made respiration and pulse ceased. The ordinary methods of resuscitation were employed for 10 minutes. Following this subdiaphragmatic massage was done for an additional 10 minutes, with no response. The diaphragm was finally incised and direct massage done which only required ten or twelve gentle squeezes to start heart action, after it had been suspended for approximately 25 minutes. The patient lived 77 hours and at autopsy metastatic sepsis was found to account for the death.

The present available statistics of 75 cases subjected to heart massage, showed that 16, or 21⅓ per cent were successful, making a complete recovery; 23, or 30⅔ per cent were partially successful in that the heart and respiration were revived, but the patients died in from one-half hour to 2 or 3 days. Death in several instances was probably due to a toxæmia which was in no way connected with the resuscitation, as, for example, my first case; nevertheless such cases have been put into the group of partial successes.

Gunn concludes from his experiments that the difficulty is not so much in starting the heart beating, but in starting it beating sufficiently soon that the cortical cells in the meantime have not been rendered incapable of recovery by stoppage of the circulation. To substantiate this, in the last reported 10 cases cardiac action was established in all, but only two made complete recovery. It is also concluded by Gunn that the time limit for revival of the cortical cells can be calculated not as from the start of spontaneous heart beats, but as from the time of beginning massage, pointing out the value of artificial circulation which is of fundamental importance and puts a more hopeful outlook on the whole question of resuscitation.

However, from these figures we can rightly conclude that the results in the main have been favorable in that more than one-fifth of the cases have been saved, and more than half of the total number have been resuscitated in a measure. The question now arises: How can we adjust heart massage in proper accord with its surgical bearings and save more of these cases? In studying the reports the successful cases have been most naturally those that were subjected to massage early in the syncope, and the possibility of resuscitation bears a somewhat definite relation to the time that elapses between the cessation and the massage. How long one is justified in waiting while carrying out the ordinary means of resuscitation before resorting to massage, may be judged in a measure from the fact that there have been but two recoveries when the syncope has lasted more than 10 minutes, and the largest measure of success has been when the interval did not exceed 5 minutes. Mollison's case made a good recovery after an

interval of 13 minutes, but showed profound mental symptoms for several weeks. Mollison and others have pointed out that the anæmia of the brain after a questionable interval produces irreparable damage to the delicate brain cells and other vital organs.

Fisher and Gunn advise boldness of procedure if heart has been stopped 3 or 4 minutes, stating there can be no further risk. Russell judges from experiments, clinical experience and reports of recoveries after massage that "we are probably safe in assuming that about 5 minutes' loss of circulation is the outside limit that the human brain can withstand and recover completely."

Norbury has recently advocated massage after giving other methods a trial of only 2 minutes, and concludes that the fact that artificial respiration can be of no use in the absence of circulation is often overlooked.

My conclusions from clinical experience are in entire accord with those reached by Fisher, Gunn, and Russell in research laboratories, that is, massage should be resorted to in any case in 4 or 5 minutes, and if the abdomen be already open, massage should be commenced at once. A lapse of a longer interval should not bar this procedure. When the operation is decided upon the subdiaphragmatic method should be first done, it being the simplest, but in obstinate cases, especially in adults, where satisfactory compression of the heart below the diaphragm is impossible, as it was in my cases, this method should be dispensed with in 2 or 3 minutes in favor of the transdiaphragmatic method.

Another point of interest in this connection is the relatively small number of cases that have had the advantage of heart massage, as compared with the number that probably goes into the thousands, of so-called, "died on the table or anæsthetic death" that were never given a chance. Nearly every surgeon of broad experience has been confronted with this condition and, I might add, almost every interne or resident physician has seen these cases that "went bad under the anæsthetic," were given prolonged artificial respiration, pulmotors employed in many cases, and stimulation of various kinds and other methods of resuscitation carried out for a variable length of time, yet they fail to re-establish the circulation and the case was eventually taken to the morgue.

CONCLUSIONS

1. Heart massage is an established method for re-establishing cardiac action which has suddenly failed under general anæsthesia, and it is based both on physiological experiments and on clinical work.

2. The possibility of resuscitation bears a somewhat definite relation to the time that elapses between the cessation of the heart and the massage, and the shorter the interval the more certain is the response.

3. If the abdomen be already open, massage should be instituted at once. Otherwise not more than 4 or 5 minutes should be consumed in attempting resuscitation by ordinary methods. If, for unavoidable reasons, more than 4 or 5 minutes have elapsed, the procedure should not be barred.

4. Subdiaphragmatic massage may suffice, especially in children and if promptly undertaken, but if only the apex is reached and the heart remains unresponsive after 2 or 3 minutes, it should be dispensed with in favor of the transdiaphragmatic method.

5. This new technique offers a simpler method of approach and is believed to be a decided improvement upon all other methods of doing direct heart massage, as it enables the operator to grasp the heart, involves less risk of hæmorrhage, trauma, lung collapse, and shock, and the incision can be more quickly and satisfactorily closed.

6. No surgeon, even if relatively unskilled, should be content to abandon a case without giving his patient the benefit of direct cardiac massage.

7. There is a great need for a more general use of heart massage as it will serve as a final trump card for reviving many who would otherwise perish.

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A NEW PROCEDURE IN THE TREATMENT OF ECLAMPSIA

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MAY, 1921 through this journal, I presented a preliminary statement on "A New Procedure in the Treatment of Eclampsia." In presenting the subject again, I shall make reference to additional phases of the problem sufficient to convey a rational understanding of the justification for the procedure both from the standpoint of the condition existing in the eclamptic woman and for explanation of the results I claim.

The death rate from eclampsia has not been affected materially by changes in treatment in the last one hundred years. As authority for that statement you are referred to the third edition of DeLee's *Principles and Practice of Obstetrics*, published in 1918, and Williams' *Obstetrics*, published in 1920.

That the statements in my paper may be properly correlated, I choose in the very beginning to say that my message is to urge the introduction of water in large quantities through the tube into the stomach or into the duodenum.

In eclampsia several clinical features stand out pre-eminently: the patient is unconscious or at least only semiconscious, the convulsions occurring at intervals are alarming to the physician and family alike, death apparently imminent in each one, the urine is suppressed or greatly reduced and carries albumin, and the patient is usually œdematous. The emergency may occur before, during, or after parturition.

The accepted routine treatment with which all are familiar is resorted to with sad realization of its inefficacy. In cases of recovery we thank good fortune 75 per cent and our professional efforts 25 per cent.

The term cardiorenal conveys to the mind a definite conception of related symptoms and pathology. In considering eclampsia, I propose the term hepatorenal, and believe that the term deserves permanence in that it conveys a comprehensive mental impression of the eclamptic complex. Furthermore I believe it to be a toxic hepatorenal block.

The characteristic changes induced in the liver, similar to those caused by eliminating portal circulation from the liver, together with similarity of symptomatology, point very strikingly to profound hepatic disturbance, recognition of which in association with accepted ideas referable to the kidney seem to justify the term toxic hepatorenal block. The toxic agent is probably more unlike that precipitating uræmia than is commonly held.

Total extirpation of both kidneys fails to produce a syndrome like that of eclampsia, death supervening with symptoms of drowsiness and lassitude without cerebral excitation or convulsions, after a lapse of time varying up to 22 days. Eck fistula, the anastamosis of the portal vein with the vena cava, depriving the liver of the portal circulation, on the other hand, not only causes symptoms simulating eclampsia, but produces similar histological hepatic changes. In the newborn, persistence of ductus venosus arantii produces like results.

That the condition is of the nature of a toxic block is strongly suggested by the immediate return of adequate function following therapy. The sequence following the administration of diphtheria antitoxin is no more striking nor more certain. The toxic agent seems to be from disturbed metabolism, however, rather than from viable infectious agent.

The nature of the exciting toxic agent, factors contributing to its production, site of elaboration, exact manner of its action, phenomenon of detoxication and elimination are all undetermined, in spite of vast research.

Discussion of the possibilities as to primacy in the liver or the kidney, or elsewhere in the body with secondary effect upon them is not within the scope of the title, nor necessary for comprehension of my hypothesis regarding treatment.

Pertinent to the possible nature of the toxic agent and the bio-chemistry of the liver and kidney under its influence, I will present certain facts for consideration.

The eclamptic sequence has features explainable on the hypothesis of colloidal block, either a colloidal substance of remote origin causing cessation of hepatic and renal function with cell necrosis in the liver, or a toxic colloidal block elaborated within the hepatic or renal cells themselves, consequent cumulative cortical stimulation eventuating in convulsions.

A sufficient amount of crystaloid or electrolyte delivered at the critical point will break the colloidal block. Furthermore it is an established fact that a given amount of electrolyte added slowly is less potent than if added in bulk or rapidly.

Procedures in previously accepted treatment of eclampsia are notorious in that electrolyte is delivered slowly and in dilution.

Water given by hypodermoclysis is added to the stagnant supertoxic fluids already in the tissues and tissue spaces. It is slowly absorbed and reaches the liver and kidneys fractionally and greatly attenuated. Water given by rectum is slowly absorbed, if retained, enters the hæmorrhoidal and inferior mesenteric circulation from viscera with poor absorption facilities and passes only in part by way of the portal. Water given by intravenous administration is disseminated throughout the systemic circulation and finally reaches the portal circulation greatly diluted and in fractional parts after having passed through two sets of capillaries, those of the lungs and those of the splanchnic area. Water given by way of the stomach is absorbed directly into the portal system and conveyed in highest concentration to the liver, delivering the greatest amount of electrolyte in highest concentration in minimum time. It is a significant fact that in health water given by mouth is excreted by the kidneys more promptly than if given by any of the other three ways. In further study of the biochemistry of water, it may be demonstrated that it is not easily excretable by the kidney until it has been acted upon by the liver via the portal circulation. A surprisingly large quantity will be assimilated in a brief time. That most water taken by mouth is absorbed into the portal circulation is evident from the fact that no matter how much is ingested, watery stools do not ensue.

The high degree of flatulence, the unconscious state of the patient and the ineffectiveness of even drastic cathartics, have seemed to contraindicate therapeutic gavage. The apparent similarity between postoperative ileus with gastric distention, and postpartum flatulency in eclampsia has no doubt contributed to the continuance of the assumption.

Entirely divergent factors contribute to the two conditions. In the former the abdomen has been opened and the contents have been subjected to exposure to air, to handling, to drying, to cooling, to the irritation of gauze, and often to operative procedures. In the latter sudden remarkable reduction of intra-abdominal pressure is probably a contributing factor. Peristalsis and absorption are not arrested. In the former, administration of fluids and cathartics are dangerous. In the latter the stomach will not only retain a large quantity of water but will pass it on to the intestines where absorption promptly follows. The mere volume and weight of the fluid introduced possibly contributes to stimulate normal peristaltic function, or as demonstrated by Wheelon and Thomas, the pylorus remains wide open, and the water pours rapidly out of the stomach.

Certainty that the tube is in the stomach and not in the trachea and watchfulness for onset of retching and regurgitation are necessary but are not of sufficient seriousness to condemn a method that promises to reduce mortality from over 20 per cent to an approximation of zero.

I believe the obstipation of eclampsia is due to lack of water content in the alimentary tract, unless that too is temporarily in a state of toxic block. With gavage carrying a moderate amount of saline laxative, copious, free evacuation will occur without the use of drastic cathartics.

The hepatorenal block broken, copious secretion of urine follows, perspiration pours from the skin, the convulsions cease, the mental state clears, and in a short time the albumin markedly diminishes or disappears from the urine.

Either the precursors of the toxins or the toxins themselves which precipitate the block seem to continue to be elaborated for some time after the block is broken. Unless energetic treatment is continued for a considerable time after cessation of convulsions, return of consciousness and re-establishment of renal function, the patient may promptly return to her previous desperate state.

My routine treatment in postpartum eclampsia consists in first giving a large dose of morphia hypodermatically, 0.5 to 1 grain, repeating as indicated. Every 4 hours 1 to 1.5 liters of water is put into the stomach through the tube, the larger quantity unless signs of retching supervene, in which case the tube is quickly withdrawn. I have never had regurgitation or vomiting, and have never had to stop short of a liter. In some instances the quantity has approached 2 liters. In a total of over seventy gavages, I have never recovered a drop of water introduced 4 hours previously. One to one and a half ounces of Epsom salts is given twice in the 24 hours and 20 grains of potassium acetate and citrate or some alkaline diuretic with each gavage. Excessive bedclothing, artificial heat, hot packs and bleeding are all discarded. I secure perspiration more promptly and far more copiously than by the old procedures.

The simplicity of the procedure makes it possible to render efficient treatment in the poorest home. The flatulence is combated by means of esserin, pituitrin, hot stupes and enemata. Car-

diac stimulation is used if indicated and spinal puncture if vision is affected and the eyegrounds show œdema of the disk. Even if it has to be administered by the physician himself, five or six short visits a day will suffice, leaving much time for other work.

It must be remembered that the babe is toxic and may die unless it too is given water in as large quantity as possible.

In prepartum eclamptic convulsions, I think it advisable to use the duodenal tube, as the stomach probably would not retain a liter and a half of water at one time, while it is very easy to introduce that amount into the duodenum in a very short time. The tube may be left *in situ* provided the patient is conscious or attendants can prevent withdrawal.

Personally I have had no experience with the duodenal tube, as all the prepartum cases I have had were near enough term that the child was viable. The uterus was emptied immediately, one vaginal section for an eight month child, two eight months' cæsareans, one being twins and three cæsareans at term. One case was during labor with complete dilatation, so forceps were immediately applied. In all cases the postpartum routine was used without the least difficulty.

In the series of twelve cases no maternal death occurred. One child was lost, I believe due to our negligence. Following a cæsarean in a case near term we were so intent on the mother that we failed to give the nurses explicit instructions as to the care of the babe. When it was 24 hours old, it had one convulsion and died.

SUMMARY

In the eclamptic woman far more water can be introduced by gavage than by any other route or combination of routes.

Water is introduced through its natural portal of entry insuring more rapid absorption and elimination by the kidney.

The water is nearly all delivered quickly and directly to the liver through the portal circulation.

If eclampsia is a toxic hepatorenal block a maximum of electrolyte is delivered at the critical point in minimum time insuring the promptest possible break of the block.

The procedure simplifies the treatment of eclampsia making efficient treatment possible in the home.

In my hands the procedure seems to have reduced mortality in excess of any contribution during the last century.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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THE SCOPE AND TEACHING OF PLASTIC SURGERY

As considerable misapprehension exists among both surgeons and physicians as to the scope of plastic surgery and the training necessary to do this work properly, it seems advisable to make these points clear. Plastic surgery is that branch of general surgery which deals with the repair of defects caused by disease, trauma, burns, and necessarily mutilating operations, and with the correction of certain congenital malformations. Its field extends from the top of the head to the bottom of the foot, and the lesions dealt with, in most instances, involve the skin and adjacent soft parts, and often the framework (especially of the face) supporting these parts.

Plastic surgery of the trunk and extremeties, a most important part of the subject, was entirely ignored by the military medical services during the war (1914–1918), and they showed a profound lack of knowledge of the scope of the subject by restricting the field to maxillofacial reconstruction. This has led many, who previously knew nothing of plastic surgery, to the conclusion that facial reconstruction is all of plastic surgery, when as a matter of fact it is only one part. It is most important, if its possibilities are to be understood, that the subject be visualized as a whole, and not be thought of from the viewpoint of any of its subdivisions.

For years it had been urged by those familiar with the intricacies of plastic surgery, that it should be separated from the general surgical tree and that special training should be given in preparation for this difficult work.

Little heed was taken of this advice, and in consequence when wounded men began to come in who required facial reconstruction and were sent to the "Head Section," few knew how to take care of them. It was then realized that special training was essential in order to do this work properly. Experience elsewhere has shown that this also applies in an equal degree to the plastic problems of the trunk and extremities, which differ materially from those of the face.

In the wards of every general hospital, on every surgical service, we constantly find cases which should be on the plastic service, if one existed, and which are simply being "carried along." This condition cannot continue, and we may confidently expect within the next few years, that there will be a plastic service in every large hospital under the charge of a surgeon who is prepared to deal with plastic problems of the entire body. Investigation shows that the teaching of this important subject has been sadly neglected, and as yet there is no department equipped for the proper instruction of plastic surgery, as a whole, in any American or foreign university.

The following is suggested as a general plan for the teaching of plastic surgery. The first requirement is that a competent plastic surgeon should be in charge of the plastic service and of the teaching of the subject. The term *general plastic surgeon* is used to distinguish the surgeons who have given special attention to plastic problems of the entire body, from those who have confined their work to facial reconstruction of one sort or another. As many ward beds as are needed should be assigned to the plastic service, and also as many house-officers as are required. In short, all necessary equipment should be supplied for the care of patients and for the teaching of the subject as a whole. During the third year a short series of lectures should be given which should cover, in a general way, the entire field. Numerous lantern slides should be used to illustrate the plastic problems and the procedures necessary to solve them. This will show the students the scope of the subject and give them an opportunity of knowing what can be done in this field.

During the fourth year, plastic surgery should be an elective course for those interested, and the fundamentals should be taken up systematically by means of practical work in the out-patient plastic clinic, and by conferences and demonstrations in the operating room and in the wards. As "an adequate practical training in the principles and practice of general surgery" is necessary as a preparation for any real surgical specialty, it follows that the final instruction in plastic surgery should be given to the post-graduate student. These men should be carefully selected, as it is impossible to make a plastic surgeon out of a man who has no aptitude for it. The post-graduate student should have the opportunity of working in the plastic clinic of the out-patient department, the privilege of the operative clinic with an opportunity of assisting and receiving personal instruction in operative technique, and eventually be allowed to perform operations under the direction of the chief. He should have the privilege of following the cases in the wards and of studying post-operative treatment, and the chance to do experimental and clinical research on plastic problems. He should be able to study in the pathological laboratory the tissues removed at operations.

Men of special ability should be taken into the house on the plastic service, and given every opportunity. The course should be at least one year, preferably two. As soon as adequate courses are offered, there will be little difficulty in attracting suitable men to this fascinating branch of surgery, in which is found an infinite number of difficult problems, the solution of which calls for the keenest judgment and the highest type of surgical skill. JOHN STAIGE DAVIS.

END-RESULTS IN ULCER OF THE STOMACH AND DUODENUM

ONE of the subjects appointed for discussion at the 1922 meeting of the American Surgical Association was: "End-Results Following Surgical Treatment of Ulcer of the Stomach and Duodenum." Comprehensive reports were made from the Massachusetts General Hospital in Boston, the Roosevelt and the New York hospitals in New York, and the Lankenau Hospital in Philadelphia. In the Massachusetts General Hospital cases of ulcer are first studied medically with careful investigation by the X-ray. They are then studied from a gastro-enterologic standpoint and are finally referred for operation. A collaborated investigation of these cases by all the departments revealed that about 95 per cent of duodenal ulcers and more than 90 per cent of gastric ulcers are

cured by operation. These results are similar to those obtained in the other hospitals represented. In the discussion that followed, views were freely exchanged with more or less clearing of the mental fog which obscures this subject.

A review of the cases of ulcer of the stomach and duodenum in our Clinic shows that less than 5 per cent of patients operated on for duodenal ulcer, and less than 10 per cent of those operated on for gastric ulcer fail to obtain satisfactory relief. Our investigations have brought out certain extremely important points with regard to the causes of failure to relieve such patients by surgical measures. The unsatisfactory cases may be divided into two groups:

Group 1. Cases in which failure is the result of faulty surgical methods; (a) placing the opening too far to the left on the body of the stomach so that the pyloric end does not drain well; (b) failure to bring the gastro-enterostomy to the bottom of the stomach, as pointed out by Ochsner; (c) in performing posterior gastro-enterostomy failure to make the opening in the transverse mesocolon sufficiently large, and to suture it firmly to the posterior wall of the stomach, so that subsequently the mesocolon becomes detached from the stomach, drops down over the two limbs of the jejunum at the gastro-enterostomy, causing angulation with insufficient drainage or, at intervals, chronic bile regurgitation; and (d) in adjusting the jejunum to the posterior wall of the stomach too short or too long, without regard to the size or the situation of the stomach.

Gastrojejunal ulcer occurs in 1 or 2 per cent of cases following gastro-enterostomy. In such cases the gastro-enterostomy should be cut off and the gastric and jejunal openings closed. If the ulcer is duodenal, a pyloroplasty should be made after the method of Finney, and if it is gastric, failure of the first operation to give relief usually indicates partial gastrectomy with removal of the entire ulcer-bearing area, as advised by Rodman many years ago.

Group 2. In about one-half the cases of unsatisfactory results the failure is due to faulty dietetics following operation, such as delay beyond the usual time of eating, overloading the stomach, and general faulty subsequent management. Such patients are cured very quickly by competent internists.

The large majority of cases of peptic ulcer seen early are amenable to medical treatment. Only the chronic intractable cases, or the acute cases giving rise to hæmorrhage or localized peritonitis, with signs of perforation are considered for operation. But it should be remembered that the greater number of patients with chronic ulcer are working and have neither the time, nor the money, for prolonged medical treatment. I have not seen a better summing up of the present day indications for surgical treatment than that of Bennett, physician to the Middlesex Hospital in London. He believes that prompt surgical treatment should be given in: (a) all cases with chronic pyloric obstruction; (b) all cases which have relapsed after one course of thorough medical treatment; (c) all cases with a history extending over many years; (d) all cases with large ulcers adherent to surrounding structures; (e) practically all cases in which a test meal is retained in the stomach for more than 6 hours; and (f) all cases whose economic position makes prolonged medical treatment impossible. Bennett says further: "It is surprising how large is the class of patients who must be placed in the last group," and finally concludes: "There can be no escape from the conclusion that the medical treatment of gastric ulcer is a difficult and protracted procedure." WILLIAM J. MAYO.

MASTER SURGEONS OF AMERICA

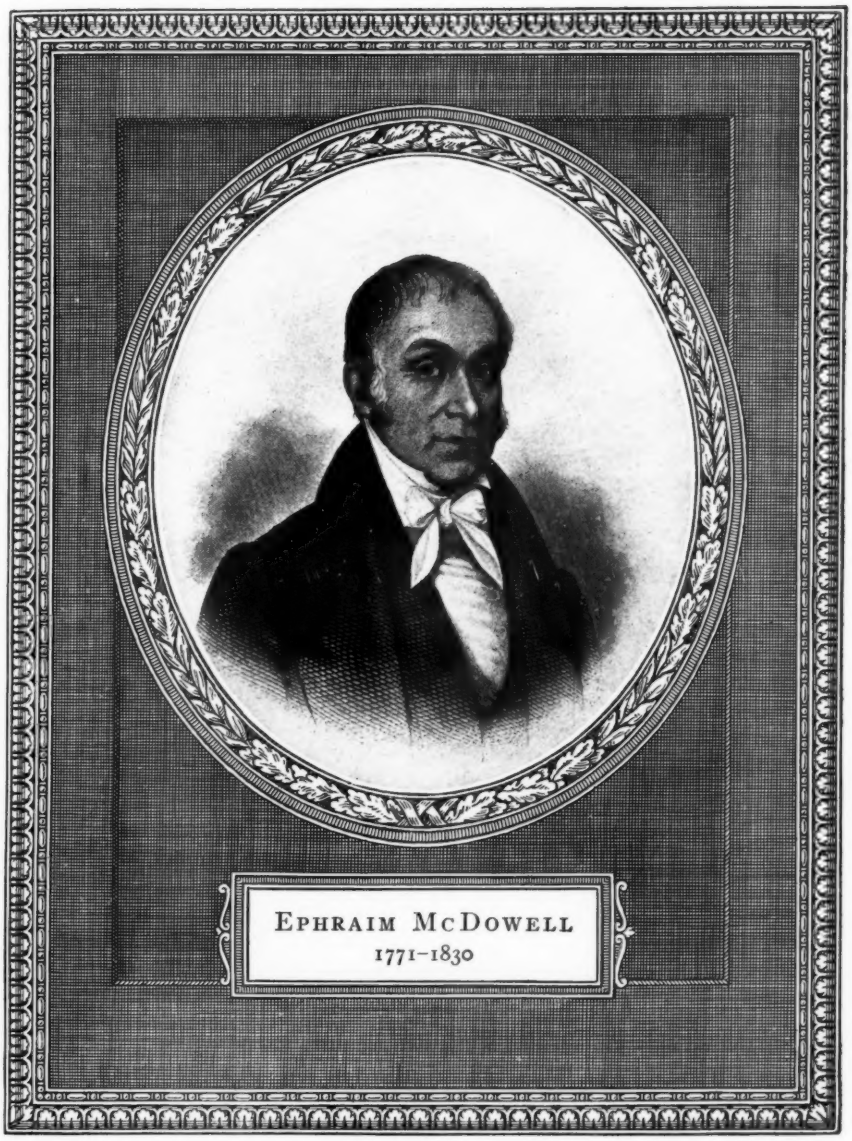
EPHRAIM McDOWELL

IT is difficult for the modern surgeon, endowed with the accumulated resources of science, to realize how comparatively recent are the epoch-making discoveries of anæsthesia (1846) and antisepsis (1875–1880). Ephraim McDowell, the subject of this brief sketch died in 1830, seventeen years prior to the discovery of anæsthesia. These historic data are essential to an appreciation of the magnitude of his undertaking and the difficulties attending its accomplishment. He founded abdominal surgery.

Ephraim McDowell was born in Rockbridge County, Virginia, in 1771. His father, Samuel McDowell, and his mother, Sarah McClung McDowell, were members of Scotch families, who, on account of religious persecution, took refuge in the north of Ireland and later emigrated to the valley of Virginia. In 1783 his father removed to Kentucky which was then a part of Virginia. Having received appointment as Judge of the District Court of Kentucky, he removed his family to Danville, which thence became their permanent home.

Ephraim McDowell received his early education at a classical seminary at Georgetown, Kentucky. He then went to Staunton, Virginia, and became an office pupil of Dr. Humphreys, a noted medical practitioner of that place. Dr. Humphreys was a graduate of the University of Edinburgh, and it was through his influence that McDowell in 1793 went to that famous university to pursue his medical course. He remained in Edinburgh two years, returning to Danville in 1795 to enter upon the practice of his profession. Bearing in mind the limited requirements in medical education of the period, and that Edinburgh at that time was pre-eminent throughout the world as a center of medical culture, it is apparent that, both in preparatory study and medical instruction, McDowell enjoyed advantages unsurpassed by any of his professional contemporaries in America.

While attending the medical course at the University of Edinburgh, he was a member of the private class of John Bell, at that time an extramural teacher of surgery. That he was most profoundly impressed by the teaching of this able and eloquent Scotch surgeon, and that he received from him inspirations that influenced him throughout his career, cannot be doubted. For some reason, most probably technical, he did not receive a medical degree in Edinburgh. In



EPHRAIM McDOWELL
1771–1830

MASTER SURGEONS OF AMERICA

EPHRAIM McDOWELL

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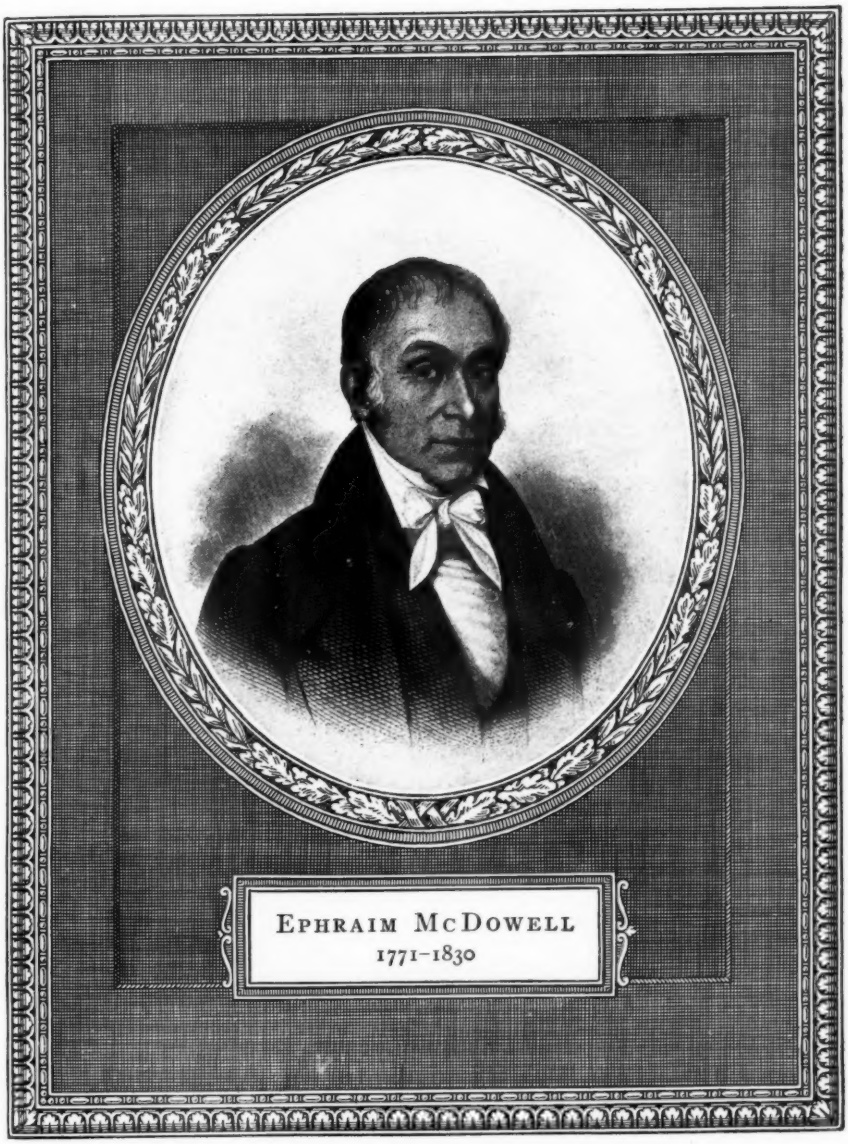


EPHRAIM McDOWELL
1771–1830

1807 the Medical Society of Philadelphia awarded him its diploma, and in 1823 the University of Maryland conferred upon him the honorary degree of M.D.

Gifted in many ways, with superior education, and coming from the most famous medical school in the world, McDowell soon assumed the first position as physician and surgeon in his locality. Within a few years his reputation extended throughout the adjoining states, and for a quarter of a century he was undisputedly the most eminent surgeon west of the Alleghanies. He made long journeys on horseback to visit and operate upon patients who were unable to visit him at home. Although doing general practice, his predilections were for surgery. He did all the surgical operations then practiced. He was especially successful in lithotomy, operated many times for strangulated hernia, and did various amputations and other operations, including tracheotomy.

In 1809, fourteen years after he began practice, his great opportunity came. He was called to see Mrs. Jane Todd Crawford, 60 miles distant from Danville, who was supposed to be pregnant, and to have gone beyond her term, with serious complications. He found the case to be one of ovarian tumor; explained the hopeless character of the disease; expressed his conviction that it was feasible to remove the tumor by operation: frankly acknowledging that it would be an experiment, since it had never been done. He inspired the confidence of his heroic patient, who accepted his proffered aid, and made the journey to Danville on horseback soon afterward. The operation was successfully performed and followed by prompt recovery.

It is known that McDowell had an excellent library for that time, and devoted much of his leisure time to his books; but like many able men of our own time, he was absorbed in practice, and literary work of every kind, especially writing, was burdensome to him. Much of his time was taken up with long journeys on horseback; he was without the stimulus of the daily mail and numerous medical journals, and no medical society existed in his section of the country. Some years elapsed after his first ovariotomy before he made a report for publication, during which time he had operated in two additional cases, both followed by recovery. The title of his paper is "Three Cases of Extirpation of Diseased Ovaries," and his description of the symptoms and operation is concise and clear, but without any detailed account of the pathology and progress after operation. That he was inspired by the teachings of his revered master, Mr. John Bell, of Edinburgh, to his great achievement may be reasonably assumed from the fact that he sent his report to him. This report failed to reach Mr. Bell, and after a time McDowell prepared a copy of his report and sent it to the *Eclectic Repertory and Analytical Review*, in Philadelphia, where it appeared in the October issue, 1816. The brevity and omission of many essential details, which characterized his report, exposed McDowell to criticism, much of which was sarcastic and incredulous. The learned editor of the London *Medico-*

Chirurgical Review expressed outright his disbelief of his statements. A few years later when the accuracy of McDowell's report had been verified and confirmed by the report of additional cases, the editor acknowledged his error and apologized for the injustice of his criticism.

In October, 1819, three years subsequent to his first publication, he reported in the same journal two additional cases. A fair estimate of his surgical ideals can be formed from a paragraph in this report, in which, replying to some criticisms upon his first report, he says: "I thought my statement sufficiently explicit to warrant any surgeon's performing the operation when necessary without hazarding the odium of making an experiment: and I think my description of the mode of operating, and of the anatomy of the parts concerned, clear enough to enable any good anatomist, possessing the judgment requisite for a surgeon, to operate with safety. I hope no operator of any other description may ever attempt it. It is my most ardent wish that this operation may remain to the mechanical surgeon forever incomprehensible."

From the best information available it appears that McDowell performed the operation in thirteen cases with eight recoveries.

McDowell was a man of impressive personality. He was nearly 6 feet tall, of athletic build, and while a student in Edinburgh was noted as a foot-racer. He was courteous and dignified in manner, amiable and cheerful, kind-hearted and charitable. His habits were exemplary, and as a citizen he was helpful in all movements for community welfare. In education he was especially interested, being one of the founders and a member of the first board of trustees of Centre College at Danville, Kentucky's most famous institution of learning. He married a daughter of Kentucky's first Governor, Isaac Shelby, a great statesman and soldier. To them were born five children, three of whom survived their father. He died of an acute illness in his fifty-ninth year.

None of the great pathfinders in American medicine and surgery has been so honored by his successors as has the subject of this sketch. In 1852 Professor Samuel D. Gross, then a resident of Louisville, sought out by correspondence and personal interview the associates, relatives, and former patients of McDowell, gathered together his reports of his operations, and wrote a biography marked throughout by the accuracy and zeal characteristic of this master surgeon. He established beyond question his priority in this field of surgery, and won for him the appreciative recognition of surgeons everywhere. In 1873 Dr. John Davies Jackson, of Danville, Kentucky, supplemented the work of Gross by a memoir which verified the accuracy of Gross' investigations. In 1879 the Kentucky State Medical Society erected a monument over McDowell's grave in McDowell Park, in Danville. The dedication of the monument was most impressive, the principal address being made by Professor Gross. The proceedings of this occasion were published in the *McDowell Memorial Volume*, which was widely

distributed. In 1909, when a century had elapsed since McDowell's first ovariotomy, the American Gynecological Society held a meeting in New York City in his honor. Papers were presented by Fellows of the Society upon McDowell's life and original work, and representative surgeons from Great Britain, France, and Germany attended in person and presented papers paying tribute to McDowell's achievement. These papers were published in a special volume of the Transactions, marked *McDowell Centennial*. Dr. E. R. Peaslee dedicated his classic work on "Ovarian Tumors" to the memory of Ephraim McDowell, as did also Dr. Washington L. Atlee with his treatise on the same subject. Space will not permit even an enumeration of other proceedings and publications at home and abroad, which honor McDowell's memory. Upon the pages of every modern treatise on surgery and gynecology his name will be found.

During many years McDowell's operation (ovariotomy) failed to maintain professional approval, and even after anæsthesia was established for a long time it had few followers. It was bitterly opposed, and its followers denounced by many in high places; but practiced by a few brave spirits who carried on despite opposition and heavy mortality, it lived and grew in confidence. With the advent of the Listerian era it soon became the most successful major operation in surgery. From ovariotomy as a starting-point, surgery extended its domain to all the organs touched by the peritoneum. The original work of McDowell thus provided the fundamental knowledge which culminated in modern abdominal surgery, the crowning glory of the surgical art. L. S. McMurtry.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD NOVEMBER 3, 1922, DR. FREDERICK G. DYAS, PRESIDING

PERI-ARTERIAL SYMPATHECTOMY

DR. ALBERT E. HALSTEAD AND DR. FREDERICK CHRISTOPHER: V. P., a Pullman conductor, age 55, was admitted to the medical service of Dr. Arthur R. Elliott, at St. Luke's Hospital, Chicago, on April 6, 1921. A tentative diagnosis of endarteritis obliterans was made by the admitting physician. Six weeks previous to admission the patient's right foot began to be painful and feel numb, which symptoms have become progressively worse. The pain radiated to the calf of the leg and the ankle felt weak. The patient was unable to walk more than half a block at a time and for the last 4 days and nights the pain has been excruciating and has prevented sleep. There had been no similar attack and the foot had not swelled. The patient had typhoid fever and "soft chancre" at 17 years of age, but otherwise the past history was negative. The family history was negative.

The physical examination revealed that the right pupil was slightly larger than the left and that both pupils reacted rather sluggishly to light and accommodation. The musculature of the extremities was fairly well developed—no paralysis, no tenderness save in the right foot which was painful when manipulated and to a lesser extent the right calf when palpated. The body was otherwise that of a normal healthy man.

On April 9, 1921, the blood sugar was 0.091 per cent, the blood urea nitrogen 17.47 milligrams per 100 cubic centimeters, the total non-protein nitrogen was 38.95 milligrams per 100 cubic centimeters. The Wassermann was clearly negative. There were 4,980,000 red blood cells, 10,050 white cells, 90 per cent hæmoglobin. The urine showed a faint trace of albumin, a few hyaline casts, no sugar, occasional leucocytes. A diagnosis of endarteritis obliterans was made by Dr. Arthur R. Elliott and Dr. George W. Hall.

The patient was given 4 liters of Locke's solution daily by mouth, and the duodenal tube and hot fomentations were applied to the foot. He made some improvement. On April 26, 1921, the patient was getting sodium citrate, 120 grains, Locke's solution, 64 ounces, potassium iodide, 30 grains, sodium bromide, 20 grains, chloral hydrate, 5 grains. After a few days the sodium citrate, sodium bromide and chloral were discontinued. On May 1, nitroglycerin, 1/100 grain every 2 hours for 8 doses daily, was started and continued for a week. On May 17, thyroid extract, 5 grains twice daily, was started and on May 19, sodium nitrite, 2 grains every 4 hours. On the 27th the electric oven was tried on the foot and nitroglycerin substituted for sodium nitrite. On June 4, massage of the leg was started. On June 24, 300 cubic centimeters of ½ per cent sodium citrate was given intravenously. The condition was unchanged throughout. On August 13, the patient was seen by Dr. Albert E. Halstead, who advised an attempt at periarterial sympathectomy or else an amputation.

On the 24th, the patient was transferred to the surgical service of Dr. Albert E. Halstead. Operation was performed on August 26. The femoral artery of the right leg was dissected out, so that the junction of the middle and lower thirds was visible. The adventitia was incised with great care and stripped completely off for a distance of 5 centimeters. The wound healed rapidly and cleanly, and the patient was discharged on the thirteenth day after operation, September 8, 1921. On July 21, 1922, 10 months after operation, the patient was admitted to St. Luke's Hospital for carbuncle of the neck. Operation of incision and drainage was carried out.

He is working as a cashier in a restaurant and is on his feet most of the 12 hours which he is on duty. He is able to walk a mile or more. There is no pain in the leg except a slight one if he walks rapidly. Numbness which was present at the time of operation has practically all disappeared. Before the operation the patient was unable to do anything and the pain was most severe when lying in bed. Now there is no pain. His general health is excellent. Leg used to be cold but gets warm in bed now. Tactile and thermal discriminations are normal. The scar is pale and the wound cleanly healed.

DISCUSSION

DR. R. W. MCNEALY: My experience with the operation of peri-arterial sympathectomy as practiced by Leriche is limited to three cases. For the privilege of operating on these cases I am indebted to Drs. Cubbins, Speed, and George Davis, as they were transferred to me from their services at Cook County Hospital. The first case was that of

a man, 38 years of age, who came with a diagnosis of Raynaud's disease. He gave a rather typical history, and at the time he entered my service was unable to walk, as a result of pain and impending gangrene of one toe. At operation the peri-arterial sheath of the femoral artery was removed over a distance of about 7 centimeters. Within a few days he complained less of pain and in 10 days left the hospital with an improvement in the peripheral circulation in the extremity and able to walk with no pain.

The other two cases were cases diagnosed as endarteritis obliterans, in men 30 and 35 years of age. Similar technique was used on these patients and a transient improvement seemed to follow, but gangrene made it necessary to do rather high amputations in both cases at a subsequent date. Microscopic and macroscopic examination in these cases makes me very skeptical of the advantage of this operation in this particular group of cases. The lumens of these vessels we reduced to exceedingly small channels and their walls were thick and irregular. The slight dilatation following operative work seems too limited to do much, and I feel that one must place little hope in successfully combating cases of endarteritis obliterans. They can be saved much time and suffering by high amputations, i.e., above the popliteal bifurcation. In conclusion, I may say that the operation is not as simple as it would appear in the hands of a skillful surgeon like Dr. Halstead. I firmly believe it has a useful field, especially in the so-called neurovascular conditions.

Dr. David C. Straus: I wish to report my experience with peri-arterial sympathectomy in two cases of thrombo-angeitis obliterans. I believe these were the first two cases of peri-arterial sympathectomy performed in Chicago for this condition. They were both on my service at the Michael Reese Hospital.

The first case, a male patient, 48 years of age, came to the Michael Reese Hospital, January 1, 1922, with the typical symptoms and findings of thrombo-angeitis obliterans of the right foot, of four weeks' duration. The entire foot was cold and dry; all toes were red and swollen, but the condition was most marked in the right first toe, which was slightly cyanotic and distinctly tender, and pain was so severe as to prevent sleep.

Since reading Leriche's article on periarterial sympathectomy, which he read before the American Surgical Association, and which was published in the *Annals of Surgery*, October, 1921, I had been eagerly awaiting an opportunity to try his operation. However, before resorting to this measure in this case I decided to give the patient the benefit of the Koga method of treatment, that is, the introduction beneath the skin of Ringer's solution every second day, and this was carried out from January 5 to January 28. I was the first to use this method in Chicago, and my report[1] of two cases before this Society in 1915 was the first report in the American literature on this subject.

The patient was given 2000 cubic centimeters of Ringer's solution subcutaneously every second day from January 5 to January 13. From January 13 to January 28, he drank 4,000 to 5,000 cubic centimeters of Locke's solution and 5000 cubic centimeters of water every 24 hours. In spite of this treatment, the condition of the great toe gradually became worse. Consequently on January 28 I felt justified in trying Leriche's peri-arterial sympathectomy. The right femoral artery was exposed, and its sheath was completely dissected away for a distance of 8 centimeters. As soon as this was done, the artery contracted to about one-third of its former diameter. The result following the operation was striking. That night the foot, which before the operation had been cold and dry, and reminded one of a cadaver, now became warm and perspired profusely, wetting the sheet. The pain, however, still continued temporarily. The next day the findings remained as just mentioned, except for the fact that the toes were now less swollen and less red. The second day after the operation another interesting phenomenon was observed. While there was less swelling than on the day immediately after the operation, there were periods during this second day during which the swelling would suddenly appear and be more marked than it had been at any time, and then suddenly disappear again, i.e., vasomotor upset. This occurred several times during the day. This phenomenon continued for 2 more days and then disappeared. With its disappearance the pain entirely subsided, the foot remained warm and moist, and the operation seemed a great success.

However, although the foot remained warm and moist, the great toe gradually underwent dry gangrene and with this there was the usual pain. On March 9 the great toe was disarticulated, and the patient was discharged, March 27, 1922, with the wound entirely healed. Although the operation did not succeed in saving the great toe, yet the results were very encouraging and the operation seemed to hasten the formation of the line of demarcation.

The second patient, a man, 31 years of age, entered the hospital, December 14, 1921, because of pain in the second toe of the right foot which had been present for 6 weeks. This prevented sleep and was associated with a feeling of coldness of the entire foot. The toe was not swollen, but was slightly discolored, cyanotic and cool and tender on palpation. The third toe showed similar findings, but to a less degree. The history and findings were typical of thrombo-angeitis obliterans. The patient was put on the Koga treatment, but with only slight success. The first patient mentioned above had just recently been operated on and was so delighted with his result that he strongly advised this patient to undergo the same operation. On February 9, peri-arterial sympathectomy was performed as no real improvement had taken place. I exposed the femoral artery high up and completely removed its

[1] Surg., Gynec. & Obst., 1915, xxi, 534-535.

sheath for a distance of about 5 centimeters. The artery was not much larger than a lead pencil and when its sheath had been removed the artery contracted to about one-third of this size. From the day after the operation there was no more pain. The cyanosis of the second and third toe was less marked, but did not entirely disappear. The entire foot was warm and felt comfortable. The patient was delighted to be relieved of the cold sensation of the foot. He was discharged on February 20 and was advised to return if the pain recurred.

He returned to the hospital on April 14, with gangrene of the second and third toe. These were amputated by Dr. Bettman. As the foot did not do well, and the gangrene spread, Dr. Bettman performed an amputation through the lower third of the thigh on May 5. Patient was discharged May 31, the stump being entirely healed.

Leriche in his report stated that he had performed his operation 64 times. He had no case of thrombo-angeitis obliterans. He had one case of intermittent claudication and one case of erythromelalgia, but in both of these the operation failed. In my two cases the immediate effect of the operation was exactly as that described by Leriche. The primary contracture occurs as soon as the sheath of the artery is removed and lasts from 5 to 15 hours. After this time the secondary vasodilatation occurs. This is evidenced by the local elevation of temperature (2 to 3 degrees), sweating, and the subjective sensation of warmth. This vasodilatation is only transitory, becoming attenuated from the fifth to sixth day, and disappears entirely after 3 or 4 weeks.

The beneficial results from peri-arterial sympathectomy are often only temporary as in my two cases. This is probably explained by the fact that the sympathetic nerves regenerate very quickly, or by the fact that the vasodilator reaction is only transitory.

DR. DANIEL N. EISENDRATH: We have had a large number of these cases at the Michael Reese Hospital in all stages. I tried the operation recommended by Lilienthal of dividing the greatly enlarged nerve on the coat of the femoral artery without any relief. I think Dr. McNealy's point is well taken, as emphasized by Dr. Straus. The Leriche operation for thrombo-angeitis obliterans is only applicable to cases in the early stages. Our experience at the Michael Reese Hospital is one of the largest in the city. We seem to have among the younger Jewish people of 30 or more a number of these cases. The youngest patient I have seen was 25 years of age. We get these cases up to 40 and 45 years of age. We find on dissecting these limbs what Dr. McNealy said, namely, once the condition has gone beyond the blue stage and there is threatening gangrene, the thrombosis is not only present in the immediate vicinity of the threatened gangrenous area, but it extends up usually to the point of the popliteal bifurcation. For that reason we find in many instances that it is of no benefit to amputate the toes. We are forced gradually to amputate higher and higher until we get finally to the point where a Gritti-Stokes or high thigh amputation must be done.

The result in Dr. Halstead's case was excellent, and the operation is well worthy of trial in the early cases. Once the artery is extensively thrombosed, it is perfectly useless from a theoretical standpoint to operate.

DR. HALSTEAD (closing): It is a well known fact that in endarteritis obliterans the trouble begins at the bifurcation of the popliteal. This was pointed out by Schede many years ago who advocated in all cases in which the gangrene had involved the dorsum of the foot, amputation above the knee. It goes without saying that an operation of this kind would not do any good, although it has been tried. When you have a favorable result from this operation you can make up your mind it is not an obliterating endarteritis.

The operation has been performed for too many conditions to make one think well of it, but in trophic disturbances and in cases where there is a vasomotor basis for the trophic disturbances, it is well worthy of trial. It is a simple operation, and I can see no reason why there should be any mortality with it.

DR. EISENDRATH: I would like to ask Dr. Halstead if he distinguishes between obliterating endarteritis as we used to consider it, namely, when the disease occurs more particularly in older patients, or whether he speaks of thrombo-angeitis obliterans which occurs in young people.

DR. HALSTEAD: I think it is the same thing.

A NEW METHOD OF GALL-BLADDER DISSECTION WITH A CONSIDERATION OF THE SURGICAL ANATOMY

DR. GOLDER L. MCWHORTER read a paper entitled "A New Method of Gall-Bladder Dissection with a Consideration of the Surgical Anatomy." (See p. 256).

DISCUSSION

DR. DANIEL N. EISENDRATH: The method described by the essayist is easy in patients who have not much inflammatory disturbance. We so often have great infiltration of the peritoneum and tissues around the junction of the cystic and hepatic ducts, where these anomalous vessels lie.

My great objection to beginning dissection at the fundus is that in case of great infiltration of the gall-bladder wall, it is impossible to secure a subserous separation and we have so much bleeding from the gall-bladder bed and the tissues around the neck of the gall bladder are so stained and infiltrated with blood that it is difficult to distinguish them. I believe in these cases one accomplishes more by avoiding the point that the essayist emphasizes in his technique in trying to mobilize the gall bladder from its bed, because the blood flows down and

obscures the common and hepatic ducts, and prevents us from identifying the very structures we most desire to avoid injury to.

The essayist's method is based to a great extent upon a need for cholecystectomy alone, but as gall-bladder surgery advances that is not enough. Everybody who does this work must be able when he finishes the operation, to feel confident that he is not obliged to operate a second time to find something in the common duct that he should have found the first time. I remove the gall bladder last of all, after inspecting and opening the common duct, wherever indicated.

It is unfortunate in giving his anatomical observations that the essayist did not quote the statistics of Rio Branco and Descomps who laid the foundation for the study of all of these anomalies, and also that he did not say a little more about the anomalies of the mode of union of the cystic and hepatic ducts, because it is not only blood-vessel injury that occurs by putting a clamp blindly on the cystic duct, but also common and hepatic duct injury. The inexperienced operator by doing what Dr. McWhorter has shown here, using clamps around the hepatic and cystic ducts is apt to include in badly inflamed cases more of the tissues than desired. I have adopted the technique of isolating these structures and of actually seeing what I am doing before I proceed further, and never put on a clamp. I use a ligature carrier and ligate the cystic duct separately from the vessels. I want to see the cystic duct isolated from the cystic artery before ligation, and not catch them together in a clamp or a ligature.

This work of Dr. McWhorter's is a step in advance, and it is very gratifying because at the time I presented a paper on vessel and duct anomalies before the society, we were told that this was of theoretical rather than of practical value. I have heard from various surgeons in all parts of the country since, who are paying more and more attention to these anomalies than was done a few years ago that they are grateful for having their attention called to these anomalies.

DR. MCWHORTER (closing): With reference to the statement made that practically this same method has been used before, I will say that I have looked through all available textbooks and the literature very carefully since I developed it and I have been unable to find anything that could be called a similar method. The lateral incision may have been used in conjunction with the older methods of freeing the bladder, but the steps of this method are the lateral approach freeing the bladder posteriorly first at the pelvis, and then dissecting down posteriorly to the cystic duct, which is freed with the distal ligation of the branches of the cystic artery in their mesentery. I feel that this method has never been used before.

Going through the left fold of the peritoneum is a step which proves that you have dissected the lower end of the gall bladder completely from its bed and is not a necessary step of the operation. This bed in the lower end of the gall bladder may be liver or connective tissue. In many of these gall bladders there is a liver attachment to the larger portion, but when you get near the cystic duct, it is loose connective tissue, making it easy to dissect in these cases from the posterior approach.

Dr. Eisendrath suggests that it would be a difficult operation in cases in which there is infiltration of the gall-bladder wall. I shall simply say that I developed this technique clinically on a particularly difficult case. The gall bladder was thickened, œdematous, friable, and contained many stones. I aspirated the gall bladder and obtained only a small amount of fluid. The gall bladder was still distended, friable, and congested. Since in previous cases I have had considerable bleeding from attempting to dissect from the fundus down, I dissected from the lateral side and approached the cystic duct posteriorly, and the method worked out almost by itself. For me, at least, I have found this method of decided advantage, and I feel safer in doing it than I have felt with any other method.

Bleeding from the gall-bladder bed on the liver, as Dr. Eisendrath said, does occur. It occurs in a dissection from the fundus down and I did not try it on this particular case because I knew there would be a lot of bleeding, since the condition was acute and the gall bladder was gangrenous in one area. Since using the method described, it has been my experience that the larger blood vessels come into the body of the bladder from the liver above the region that is first freed. Consequently there is practically no bleeding. There may be some oozing at first, but it is infinitesimal, and I have never dissected the duct in a bloody field by this method.

As to the reference to findings by other anatomists and comparing them to mine, I did not wish to make my paper too long. I wanted to bring out the anomalies, in order to emphasize the safety of my method especially where the cystic duct is dissected from the neck down so that there could not be any anomalous hepatic branch going into the bladder, or so that the cystic duct could not empty, anomalously, into the right branch of the hepatic duct without its being recognized before cutting. This might happen easily if the cystic duct were freed first at the junction with the common duct and cut before its complete dissection to the bladder. In my method, where the neck is exposed from behind the sheet of peritoneum, and in the presence of peritoneal adhesions, the dissection is easier posteriorly. In the loose connective tissue and in œdematous tissues, the removal posteriorly is even easier than normally. If you approach it anteriorly, the dissection becomes very difficult.

DR. EINAR KEY, Stockholm, Sweden, read a paper on "Extrapleural Thoracoplasty in the Treatment of Pulmonary Tuberculosis."

DR. EMIL BECK read a paper entitled "Further Progress on the Open Method of Treatment of Inoperable Carcinoma."

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GELLHORN, M.D., F.A.C.S., St. Louis, Missouri

IN order to give it due emphasis, I have placed at the head of this "Critique" a work which, to my mind, marks a very notable addition to medical literature. In a monograph[1] of little more than 200 pages Ehrenfest deals with the subject of birth injuries of the child, setting himself the task of inquiring into the danger of birth to the infant, its relative frequency and seriousness, its causes, methods of diagnosis, of prevention, and of treatment. Never before has this subject received so exhaustive a consideration, and the book before us represents a truly encyclopædic completeness. In seventeen chapters, injuries of the scalp, the cranial bones, the intracranial contents, the vertebral column and spinal cord, the face, eye, neck, clavicle, thorax, abdomen, extremities, etc., are discussed with a comprehensiveness which neglects no essential detail. The author modestly remarks in the preface that, probably, omissions may have occurred; but a glance at the references appended to each chapter gives one the impression that at any rate no important contribution has been overlooked. The enormous mass of literature which has been collected from all parts of the civilized world, not only attests to the amazing industry of the author, but it is presented with so much critical judgment and such freshness of style that the study of the book is of absorbing interest.

The first effect of such a work must needs be on the practice of obstetrics. It should, nay, it must make better and more careful obstetricians of those who attend women in confinement. But beyond our special field the book presents reliable information and, thus, helpful suggestions for treatment to specialists in other fields of medical practice, and it thereby links obstetrics closely with pediatrics, neurology, ophthalmology, surgery, and orthopedics. And if ever the time comes when special experts in forensic medicine are recognized and demanded, this book will probably serve as a reference work in our courts.

AND here is another work that will make for better obstetrics—an excellent book which I could not lay down after I had once started, until I had read it from cover to cover. A "Course on the Mannikin"[2] it is called, and the author introduces it with the statement that it has merely been his aim to guide the student until he may become proficient in the proper obstetrical technique in the great school of actual practice. But he has given us much more than he promised. So graphic are his instructions, so epigrammatic and impressive his diction, so true and plastic the numerous illustrations that the book embodies a large part of obstetrical education. The obstetrical teacher should be glad to arrange his course along the lines indicated by a man of great teaching ability and thorough familiarity with the needs of daily practice. The practitioner who is only too apt to follow a rut and forget the finer points taught him in school, would do well to read this small book from time to time. Such a review would be particularly desirable after a difficult case so as to avoid complications the next time. The student, finally, can wish for nothing better than this book to complement the spoken word of his teacher and the actual exercises on the mannikin.

The book is, in the main, divided in five chapters dealing, respectively, with delivery in vertex presentation, transverse position, breech and unfavorable vertex presentations, the various methods of artificial dilatation, and the mutilating operations. It lies in the very nature of the subject that there is nothing absolutely new that is here presented. It is more in the way in which the problem is approached that the value of this book is to be found. Of the original, and previously published, contributions of the author, his "Kegelkugelhandgriff"—the introduction of the entire hand in cone shape for purposes of traction and rotation—and the use of a specially constructed lamp wick for traction on the high breech may be mentioned.

At the end of the book there are about six pages of aphorisms—Golden Rules, indeed, which may well be memorized by anyone engaged in obstetrical work. One example only: "Rule 5. He who applies forceps in incomplete dilatation or on the floating head, is responsible for the consequences. Many a one thought to save a child and destroyed two lives: mother and child."

I accompany the announcement of this book with my warmest recommendations.

THERE is in the human mind a static element that distrusts the new and clings to the old. Every discovery and every movement for reform

[1] Birth Injuries of the Child. By Hugo Ehrenfest, M.D., F.A.C.S. New York and London: D. Appleton & Co., 1922.

[2] Der geburtshilfliche Phantomkurs. By Prof. Dr. Wilhelm Liepmann. Berlin and Vienna: Urban & Schwarzenberg, 1922.

had to count with, and battle against, this factor. In medicine it has had its good sides in so far as it sometimes prevented a headlong acceptance of poorly founded claims, but it also has often retarded progress as in the case of Semmelweiss or McDowell. And so with these last named examples in mind, I wish to disclaim any *a priori* critical attitude toward the book before me[1] merely for the reason that it contains something entirely new. For, while version has been performed since the days of Soranus of Ephesus, and while many of the special manœuvers may have been familiar to this or that man in the past, yet, what Potter practices and teaches regarding version, is undoubtedly new, is essentially unprecedented. Who has ever before said—perhaps not exactly in these words, but in words to that effect—that the physiological mechanism of childbirth which obtains in 95 per cent of all cases, is deficient and causes more injury than a properly executed podalic version? That the convenience of the obstetrician should be one of the guiding indications for terminating labor? That podalic version, or rather, the right kind of podalic version will check the decline of the birth rate, particularly in the more intelligent and far-seeing part of the population?

No, we must assuredly give the credit of priority to the man who has deliberately broken away from the accepted standards of obstetric practice, and we are filled with a feeling akin to awe when we read that within the past 2 years the author has accomplished the colossal task of personally delivering 2,243 women, in whom he has performed version in 1,908 instances. In this monograph Potter gives a very clear and well illustrated description of his technique, presents his statistics, replies to certain criticisms of his procedure, enumerates its indications and advantages, and concludes with a plea for a universal adoption of his method.

To one who has no personal experience with the Potter version, it is obviously unbecoming to criticize the technique, particularly when the results testify to the stupendous dexterity of its originator. In fact, the reading of the sixty odd pages which deal with the author's method—and they are quickly read—gives one the impression that here is a mode of delivery that is applicable in practically all cases, normal and abnormal alike, and has no shortcomings. But a second reading makes one pause and question whether this monograph is, after all, a scientific book in the strict sense of the word.

When a startlingly new and radically different method is recommended, one would expect to find somewhere a comparison of statistics which would demonstrate in a mathematical and convincing fashion the superiority of the new over former methods in vogue. Unfortunately, such comparative statistics are lacking, though it would have been an easy matter to procure them.

The surgeon who habitually opens bellies to see "what is in them," is justly considered an empiric no matter how skillful he may be. Yet, this is precisely what Potter advocates in childbirth. He scorns all methods of obstetrical diagnosis, in particular pelvimetry, and immediately proceeds to version. Thanks to his expertness and thanks, most likely, to the fact that most pelves are normal or nearly normal, he succeeds, but if such is not the case, cæsarean section must follow. This inference impresses itself upon one's mind and it explains perhaps the 180 cæsarean sections among the 335 cases which were not delivered by version, a relative percentage of almost 54 and an absolute percentage of 8 which even in the present surgical era of obstetrics seems excessive. But granting the necessity for so large a number of cæsarean sections, would not a comparison of the mortality and morbidity of these operations with those performed under accepted indications, have greatly added to the value of the book and testified to the fairness of the author?

For these reasons the monograph somehow resembles a propaganda work, and like all other propaganda writings for whatever purpose, it distributes light and shadow unevenly.

While, thus, the book by its tenor and its construction lays itself open to criticism, no such censure applies to the personal adroitness of its author. And as to generalization? It is true that Blondel crossed the Niagara on a tight rope, but the rest of the people have always preferred the bridge across.

Yet, Potter must be considered a pathfinder. Already there are indications of it discernible—his method of "ironing out" the vagina, for instance, his protection of the mouth against aspiration, etc.

In fifty years from now a medical historian will probably consider this monograph a most interesting document of the development of obstetrical art. In the meantime let us add what seems of permanent value in Potter's method, to our obstetrical armamentarium.

A REVIEW on Koblanck's Manual was barely published in this journal[2] when the third edition of this little book[3] appeared—a sufficient proof, it seems, that the favorable opinion expressed by me has been shared by a great many others. As a matter of fact, this booklet which in its new form has increased by almost a hundred pages, meets in a most satisfactory fashion the practical needs of the specialist and the general practitioner and is particularly well adapted to the requirements of office work.

THE new edition of Crossen's textbook[4] has been improved by the addition of numerous good microphotographs and a thorough revision of the

[1] The Place of Version in Obstetrics. By Irving W. Potter, M.D., F.A.C.S. St. Louis: C. V. Mosby Co., 1922.

[2] Surg., Gyn. & Obst., 1922, xxxiv, 287.

[3] Taschenbuch der Frauenheilkunde. By Prof. Dr. Koblanck, 3rd ed Berlin and Vienna: Urban & Schwarzenberg, 1921.

[4] Diseases of Women. By Harry Sturgeon Crossen, M.D., F.A.C.S. 5th ed. St. Louis: C. V. Mosby Co., 1922.

text by the author and several collaborators. The steady appearance of new editions of this work attests to its well merited popularity among students and practitioners and confirms our previously expressed comments.

THERE are several reasons why a new obstetrical textbook for nurses should be reviewed in the columns of SURGERY, GYNECOLOGY AND OBSTETRICS. To begin with, those among the readers of this journal who are teachers in training schools want to know of a really good textbook to use for their lectures. Furthermore, all practicing obstetricians should be thoroughly conversant with the treatment of labor and puerperium as it devolves upon the nurse, but the details of this treatment are for lack of space but indifferently considered in obstetrical textbooks for students and practitioners. Finally, we all are vitally interested in any work that will help to elevate the standard of obstetrical nursing in this country. This task has been admirably well solved by Carolyn Van Blarcom.[1] As the educational requirements of nurses' training schools are widely different, it is by no means an easy matter to find just the right meeting ground, avoiding on the one hand a dogmatic brevity which furnishes no foundation for real understanding, and on the other, an exhaustive study of particulars that are clearly outside of the nurse's province. Miss Van Blarcom has evaded Scylla and Charybdis, and the way in which she describes the underlying principles of obstetrical nursing as well as the various nursing methods appeals to me as altogether praiseworthy. It is her twofold aim to prepare the nurse to be an intelligent helper to the physician in all obstetrical problems and to instill in her a sense of the great service she may be able to render mankind. One can only subscribe to the author's four cardinal requirements of the truly good nurse, namely:

1. Cleanliness—under all conditions, to protect both mother and baby from infection.
2. Watchfulness—for early symptoms of complications in either mother or baby.
3. Adaptability—to the patient, the doctor, and the surroundings.
4. Sympathy—for every mental and physical stress which the patient may suffer.

The practical value is still further enhanced by the author's instructions how hospital procedures and appliances may be improvised in a patient's home whether in a city or a rural community. The numerous illustrations, whether photographs or line drawings, are very instructive. Only one picture, that of a woman in knee-chest posture, is incorrectly drawn with the spinal column arched and should be changed in the next edition. And speaking of pictures, I wonder whether the author could not find a more radiant, a more compelling representation of young motherhood for her frontispiece. However, these are very minor details which in no way affect the great value of this book.

[1] Obstetrical Nursing; a textbook on the nursing care of the mother, the woman in labor, the young mother and her baby. By Carolyn Conant Van Blarcom, R.N. New York: The Macmillan Company, 1922.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

L'ANESTESIA LOCALE IN CHIRURGIA PEDIATRICA ED IN ORTOPEDIA. By Dr. Oreste Nuzzi. Bologna: Licinio Cappelli, 1922.

FERITE DEL TORACE. 2d ed. By Dott. Prof. Felice Rossi. Bologna: Licinio Cappelli, 1922.

IL TAGLIO CESAREO ABBOMINALE. By Dott. Piero Gall. Bologna: Licinio Cappelli, 1922.

ORGANIZZAZIONE E INDIRIZZO DI UNA SEZIONE CHIRURGICA OSPEDALIERA. By Dott. Aldo Lesi. Bologna: Licinio Cappelli, 1922.

OBSTETRICS FOR NURSES. By Everett Dudley Plass, M.D. New York and London: D. Appleton & Co., 1922.

LAWSON TAIT. His Life and Work. A Contribution to the History of Abdominal Surgery and Gynecology. By W. J. Stewart McKay, M.B., M.Ch., B.Sc. New York: William Wood & Co., 1922.

THE ANATOMY OF THE FEMALE PELVIS. By F. A. Maguire, D.S.O., M.B., Ch.M. (Syd.), F.R.C.S. (Eng). Sydney: Angus & Robertson, Ltd., 1922

GYNECOLOGICAL AND OBSTETRICAL PATHOLOGY. By Robert Tilden Frank, A.M., M.D., F.A.C.S. New York and London: D. Appleton & Co., 1922.

I BELIEVE IN GOD AND IN EVOLUTION. By William W. Keen, M.D. Philadelphia and London: J. B. Lippincott Co., 1922.

SURGERY. By Ivor Back, M.A., M.B., B.C., (Cantab.), F.R.C.S. (Eng.), and A. Tudor Edward, M.A., M.C. (Cantab.), F.R.C.S., (Eng.). London: J. & A. Churchill, 1921.

DIE FRIEDMANN-METHODE. By Dr. Victor Bock. Leipzig: S. Hirzel, 1922.

THE PROPAGANDA FOR REFORM IN PROPRIETARY MEDICINES. vol. ii. Chicago: American Medical Association, 1922.

REGIONAL ANESTHESIA; Its Technic and Clinical Application. By Gaston Labat, M.D. With a Foreword by William J. Mayo, M.D. Philadelphia and London: W. B. Saunders Co., 1922.

TEXT-BOOK OF PEDIATRICS. 1st Eng. ed. edited by Prof. E. Feer. Translated and edited by Julius Parker Sedgwick, B.S., M.D., and Carl Ahrendt Scherer, M.D. F.A.C.P. Philadelphia and London: J. B. Lippincott Co., 1922.

AMERICAN COLLEGE OF SURGEONS

STATISTICAL REPORT OF HOSPITALS MEETING THE MINIMUM STANDARD

ON the following page is a reproduction of the large map at the College headquarters, used to give an impression as to the general geographical distribution of hospitals with special designation of the approved institutions. The general distribution of hospitals, as would naturally be supposed, coincides with the density of the population, the clusters of hospitals on the map indicating the larger cities. It also brings out clearly the extreme scarcity of hospitals having fifty or more beds in certain sections of the country, especially in the Western states. In some regions, notably in the mountainous sections, one must travel almost the entire width of a state or province before finding a hospital of appreciable size.

In this map the approved hospitals are indicated by red stars and red crosses and hospitals which are not approved are indicated by black dots and black crosses, denoting in each instance the 100-bed and 50-bed hospitals respectively. A glance at the map, therefore, gives a general estimate of the proportion of approved institutions in a given section of the continent by the relative number of red and black figures.

The statistical table on page 00 gives the exact percentage of approved hospitals in each state and province, the table being subdivided into three subdivisions: hospitals having 100 or more beds; those having 50 to 100 beds; and a third subdivision including all hospitals having over 50 beds.

It is rather remarkable that, considering all hospitals having over 50 beds, there is such a small variation between the percentage of approved hospitals in the United States and Canada, namely, 62.5 per cent and 64.6 per cent respectively. This demonstrates that there is a uniformity in statistics covering hospital conditions, provided that the statistics cover a wide range of territory, as separate statistics for the United States and Canada each cover a territory extending from coast to coast and include both metropolitan and rural communities.

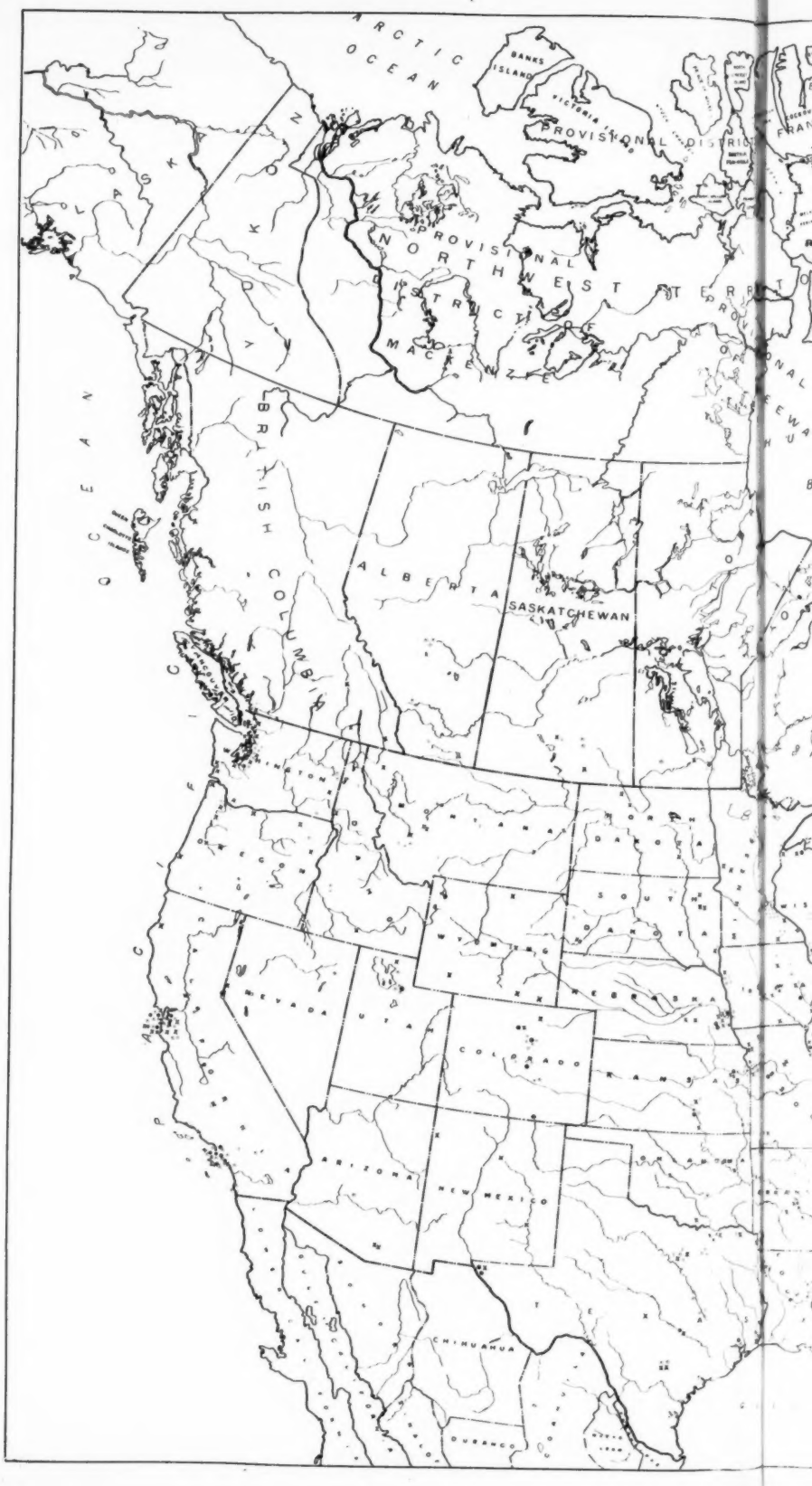
When statistics for states and provinces are compared separately, however, there is a certain element of unfairness which enters, due to the variation in the number of hospitals in the various states and provinces. For example, in the statistics covering the 100-bed hospitals, each state or province having 100 per cent of its hundred-bed hospitals approved has less than 10 hospitals of this size, with the exception of Maryland, Michigan, and Minnesota, which states have 14, 23, and 24 hundred-bed hospitals respectively—a very commendable showing. The seven states having 30 or more hundred-bed hospitals rank as follows: Ohio, 94.6 per cent approved; Massachusetts, 92.8 per cent; Pennsylvania, 89.4 per cent; New York, 84.4 per cent; California, 68 per cent; New Jersey, 82.4 per cent; and Illinois, 63.5 per cent approved.

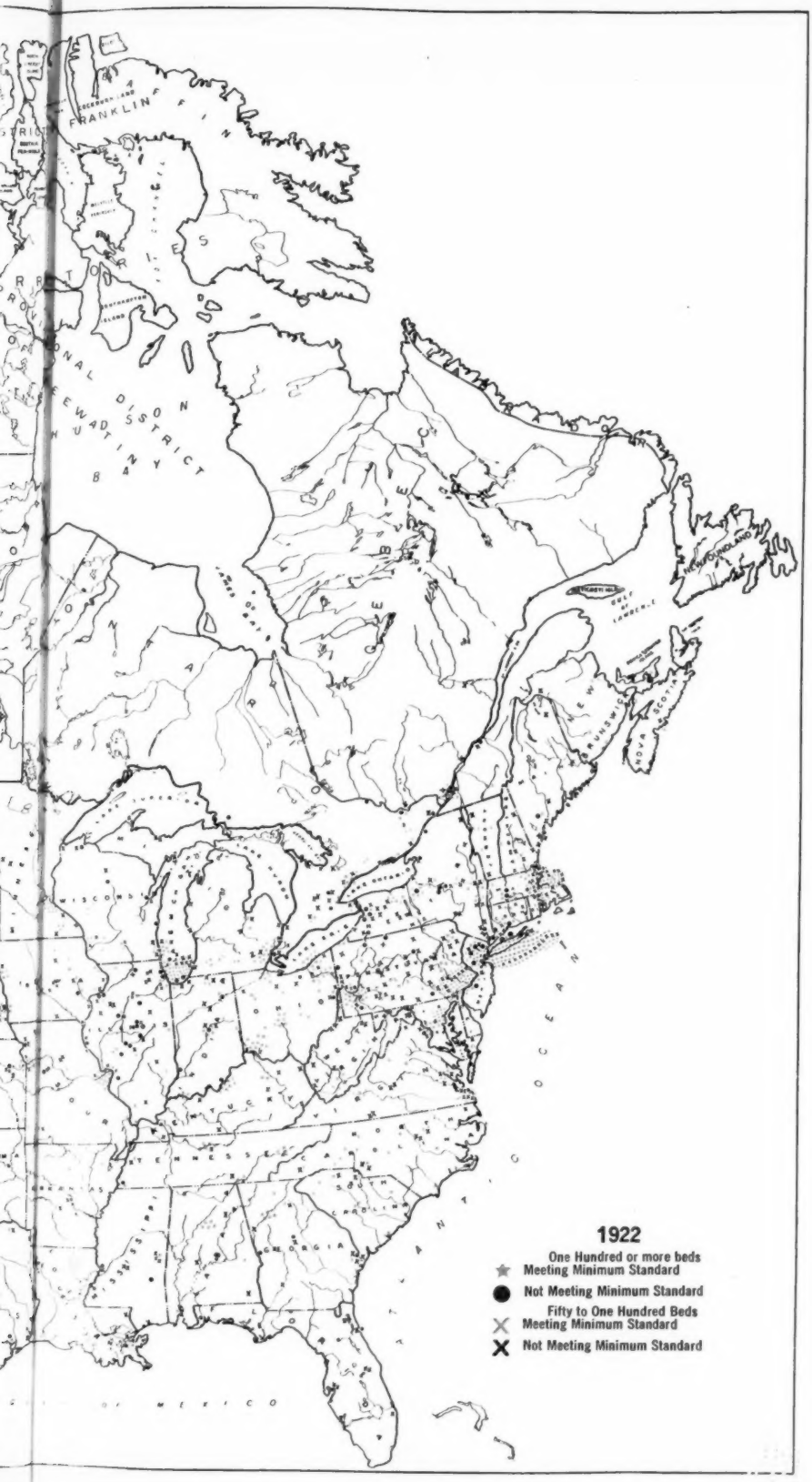
In the table of hospitals having from 50 to 100 beds, there is only one state or province having 100 per cent approved, namely, Alberta, which, however, has only two hospitals of this size. Those states or provinces having 30 or more hospitals with a capacity of from 50 to 100 beds rank as follows: Ohio, 71.4 per cent, approved; New York, 44.2 per cent; Pennsylvania, 42.2 per cent; Ontario, 36 per cent; Massachusetts, 31.4 per cent; and Illinois, 30.8 per cent, approved.

Considering all hospitals having over 50 beds, the seven states and provinces having 50 or more hospitals compare as follows: Ohio, 83.3 per cent; Pennsylvania, 67.5 per cent; New York, 67.3 per cent; Massachusetts, 65 per cent; California, 53 per cent; Ontario, 50 per cent; and Illinois, 48.7 per cent, approved.

The statistics in the above three paragraphs refer only to those states and provinces having the largest number of hospitals, the percentage of some of these being exceeded by other states and provinces having not quite as many hospitals.

The grand totals, combining the hospitals in the United States and Canada, are as follows: Out of 812 hospitals having 100 or more beds there are 677 or 83.3 per cent approved. Of those having 50 to 100 beds, 42.2 per cent or 342 of the 811 institutions meet the standard, and including all the 1623 hospitals having over 50 beds, there are 1019 or 62.7 per cent on the approved list.


ARCTIC OCEAN
BANKS ISLAND
VICTORIA
PROVISIONAL DISTRICT
YUKON
NORTHWEST TERRITORIES
DISTRICT OF MACKENZIE
ALBERTA
SASKATCHEWAN
BRITISH COLUMBIA
NEVADA
UTAH
COLORADO
ARIZONA
NEW MEXICO
CHIHUAHUA
DURANGO


1922
One Hundred or more beds
Meeting Minimum Standard
Not Meeting Minimum Standard
Fifty to One Hundred Beds
Meeting Minimum Standard
Not Meeting Minimum Standard

NUMBER OF HOSPITALS MEETING THE MINIMUM STANDARD

United States and Canada	100 or more Beds			50 to 100 Beds			All Hospitals over 50 Beds		
	Number of Hospitals	Approved		Number of Hospitals	Approved		Number of Hospitals	Approved	
		Number	Percentage		Number	Percentage		Number	Percentage
Alabama	9	8	90	8	3	37.5	17	11	64.7
Arizona	1	1	100	2	0	0	3	1	33.3
Arkansas	5	4	80	10	5	50	15	9	60
California	44	30	68	24	6	25	68	36	53
Colorado	13	9	69	4	2	50	17	11	64.7
Connecticut	15	12	80	8	1	12.5	23	13	56.7
Delaware	1	1	100	2	1	50	3	2	66.6
District of Columbia	10	9	90	3	0	0	13	9	69
Florida	4	2	50	9	2	22.2	13	4	30.8
Georgia	10	7	70	12	4	33.3	22	11	50
Idaho	1	1	100	7	4	57	8	5	62.5
Illinois	63	40	63.5	52	16	30.8	115	56	48.7
Indiana	16	12	75	17	9	53	33	21	63.6
Iowa	15	13	86.7	21	11	52.4	36	24	66.6
Kansas	6	4	66.6	19	11	58	25	15	60
Kentucky	8	8	100	14	5	35.7	22	13	59
Louisiana	7	6	85.7	7	2	28.6	14	8	57
Maine	5	3	60	7	1	14.3	12	4	33.3
Maryland	14	14	100	11	5	45.5	25	19	76
Massachusetts	42	39	92.8	35	11	31.4	77	50	65
Michigan	23	23	100	21	9	42.8	44	32	72.7
Minnesota	24	24	100	11	6	54.5	35	30	85.7
Mississippi	4	1	25	7	0	0	11	1	9
Missouri	24	22	91.7	20	10	50	44	32	73
Montana	5	5	100	11	5	45.4	16	10	62.5
Nebraska	9	6	66.6	10	3	30	19	9	47.4
Nevada	0	..	.....	2	1	50	2	1	50
New Hampshire	1	1	100	8	4	50	9	5	55.5
New Jersey	34	28	82.4	11	7	63.6	45	35	77.7
New Mexico	0	..	.....	3	0	0	3	0	0
New York	103	87	84.4	77	34	44.2	180	121	67.3
North Carolina	4	4	100	16	9	56.2	20	13	65
North Dakota	5	5	100	4	2	50	9	7	77.7
Ohio	37	35	94.6	35	25	71.4	72	60	83.3
Oklahoma	2	2	100	8	1	12.5	10	3	30
Oregon	4	4	100	11	3	27.3	15	7	46.6
Pennsylvania	83	74	89.4	71	30	42.2	154	104	67.5
Rhode Island	3	3	100	3	2	66.6	6	5	83.3
South Carolina	6	5	83.3	6	3	50	12	8	66.6
South Dakota	3	2	66.6	11	6	45.4	14	8	57
Tennessee	10	9	90	9	4	44.4	19	13	68.4
Texas	20	15	75	19	5	26.3	39	20	51.3
Utah	5	4	80	1	0	0	6	4	66.6
Vermont	1	1	100	5	3	60	6	4	66.6
Virginia	7	6	85.5	23	10	43.5	30	16	53.3
Washington	17	15	88	13	3	23	30	18	60
West Virginia	7	7	100	20	8	40	27	15	55.5
Wisconsin	22	16	72.7	24	13	54	46	29	63
Wyoming	0	..	.....	6	1	16.6	6	1	16.6
Totals for United States	752	627	82	738	306	41.5	1490	933	62.5
Alberta	6	6	100	2	2	100	8	8	100
British Columbia	6	6	100	6	1	16.6	12	7	58.3
Manitoba	6	5	83.3	2	1	50	8	6	75
New Brunswick	1	1	100	8	7	87.5	9	8	90
Nova Scotia	3	3	100	7	6	85.7	10	9	90
Ontario	23	16	69.6	31	11	36	54	27	50
Prince Edward Island	0	..	.....	3	2	66.6	3	2	66.6
Quebec	11	9	82	8	2	25	19	11	58
Saskatchewan	4	4	100	6	4	66.6	10	8	80
Totals for Canada	60	50	83.3	73	36	49.3	133	86	64.6
Grand Totals	812	677	83.3	811	342	42.2	1623	1019	62.7

ILLINOIS, INDIANA, MICHIGAN, AND OHIO SECTIONAL MEETINGS OF THE CLINICAL CONGRESS

ILLINOIS

THE Illinois State Sectional meeting of the American College of Surgeons was held in Quincy on Friday and Saturday, December 1 and 2. The arrangements for this meeting were in the hands of the local Fellows of the College with Dr. E. B. Montgomery as chairman. Registration headquarters was on the mezzanine floor of the Quincy Hotel. The usual hospital meeting took place on Friday afternoon at 2 o'clock in the Gold Room of the Hotel Newcomb. There was a good attendance and an exceedingly interesting discussion at the Round Table Conference.

The public meeting in the Presbyterian Church was packed to the doors by a large audience interested in the great movement for better health and better hospitals. Nurses from the Blessing Hospital acted as ushers. An innovation at this meeting was the broad-casting by radio of the various addresses. This arrangement was made by Dr. W. Stevenson of Quincy who is an enthusiastic radio fan, and to Dr. Stevenson and also to the local agents who so kindly provided the equipment, the hearty thanks of the College are due. This plan worked out splendidly as weather conditions were favorable and the voices of the speakers were distinctly heard over a distance of 300 miles. In addition to the representatives of the College, the following numbers were added to the program:

Address of Welcome. Bishop M. Edward Fawcett.

How the Public Can Assist in Reducing the Mortality from Cancer. Allen B. Kanavel, A.M., M.D., Professor of Surgery, Northwestern University Medical School, Chicago.

What Can Be Accomplished by Routine Prenatal Care. Charles B. Reed, M.D., Obstetrician, Wesley Memorial Hospital, Chicago.

Albert J. Ochsner, M.D., President-elect of the American College of Surgeons in a short address outlined how members were admitted to Fellowship in the College.

The musical numbers provided by Mr. and Mrs. William Spencer Johnson were very much appreciated, and our thanks are due to Mr. and Mrs. Johnson for their interest and co-operation in making the meeting so successful.

The scientific session met on Saturday afternoon in the Presbyterian Church. It was well attended and following the meeting the moving picture of the Boston Congress was shown for the first time. The scientific program was as follows:

Trigeminal Neuralgia—(Illustrated). Allen B. Kanavel, M.D., Chicago.

Surgical Lesions of the Large Bowel. Carl B. Davis, M.D., Chicago.

Some Complications of Appendicitis. Carl E. Black, M.D., Jacksonville, Illinois.

The Postmature Child. Charles B. Reed, M.D., Chicago.

Fracture of the Spine. John L. Porter, M.D., Professor of Orthopedic Surgery, Northwestern University Medical School, Chicago.

Partial Gastrectomy for Ulcer of the Lesser Curvature. Alfred A. Strauss, M.D., Attending Surgeon, Michael Reese Hospital, Chicago.

Surgical Aspect of Cancer. A. J. Ochsner, M.D., Professor of Surgery, University of Illinois College of Medicine, Chicago.

Surgical clinics and demonstrations were conducted at the local hospitals during the two days of the meetings and gave evidence of careful preparation and thought.

Immediately following the hospital meeting on Friday afternoon, there was a meeting of the Fellows of the College at which there was a good attendance.

INDIANA

THE Indiana Sectional meeting was held in Evansville on Monday and Tuesday, December 4 and 5. The headquarters and registration were at the Hotel McCurdy. The hospital meeting took place in the Ball Room of the McCurdy Hotel at 2 p.m. on Monday and was followed by the Round Table Conference and a meeting of the Fellows of the College. At this meeting of the Fellows a series of slides was shown illustrating the organization of the College and outlining the property owned and controlled by the College and the Journal. This was accompanied by a short address from the Director General.

The public meeting was held at the First Baptist Church, and although the weather was very unfavorable, there was a good attendance. In addition to the representatives of the College, the following numbers composed the program:

Surgery in Public Health. J. B. Deaver, M.D., Philadelphia.

Trigeminal Neuralgia—(Illustrated). Allen B. Kanavel, M.D., Chicago.

Prenatal Care. Charles B. Reed, M.D., Chicago.

The scientific meeting was held in conjunction with the Ohio Valley Medical Society on Tuesday 1:30 p.m. in the Auditorium of the Young Men's Christian Association. The program brought up much interesting discussion.

The series of interesting clinics was conducted at the local hospitals. On Tuesday morning a clinic was conducted at the Walker Hospital clinic by Dr. John B. Deaver. The arrangements for this meeting were in the hands of the local committee with Dr. J. Y. Welborn as chairman. The success of the meetings was due largely to the energetic efforts of this Committee.

MICHIGAN AND OHIO

THE Michigan and Ohio Sectional meeting of the American College of Surgeons was held at the Gibson Hotel, Cincinnati, on Friday and Saturday, December 8 and 9.

The hospital meeting on Friday afternoon at 2 o'clock in the Ball Room of the Hotel was fairly well attended and called forth an animated discussion on various phases of hospital standardization and management. A meeting of the Fellows of the College followed the Round Table Conference. The organization of the College was outlined and illustrated by means of slides and a short address by the Director General.

The public meeting was held in the Ball Room of the Gibson Hotel at 8 p.m. on Friday. Dr. Charles L. Bonifield presided, and besides the representatives of the College the following interesting and instructive addresses were delivered:

Experimental Medicine. William D. Haggard, M.D., Nashville. Professor of Surgery, Vanderbilt University, Medical Department.

What Can Be Accomplished by Routine Prenatal Care. Charles B. Reed, M.D., Chicago. Obstetrician, Wesley Memorial Hospital.

Influence of Modern Medicine on Life Extension. Charles A. L. Reed, M.D., Cincinnati. Emeritus Professor of Gynecology, University of Cincinnati, College of Medicine.

The scientific meeting was held on Saturday afternoon in the Gibson Hotel, and the following papers were presented:

Tumor of the Breast—A Study of 255 Cases. W. D. Haggard, M.D., Nashville, Tennessee.

Intra-Orbital Tumors. E. C. Ellett, M.D., Memphis, Tennessee.

The Postmature Child. Charles B. Reed, M.D., Chicago.

Clinics and demonstrations were conducted during the meetings at the city hospitals. These were very instructive and interesting to all those in attendance.